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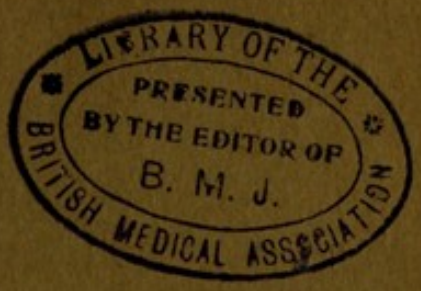
MATERIA MEDICA
FOR NURSES
BLUMGARTEN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MATERIA MEDICA FOR NURSES

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MATERIA MEDICA FOR NURSES

BY

A. S. BLUMGARTEN, M. D.

INSTRUCTOR IN MATERIA MEDICA AT THE GERMAN HOSPITAL
TRAINING SCHOOL FOR NURSES, NEW YORK

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In Memoriam

TO MY FATHER

WHOSE PATERNAL LOVE AND SYMPATHY HAS
BEEN A CONSTANT INSPIRATION TO
THE AUTHOR
THIS BOOK IS AFFECTIONATELY DEDICATED.

PREFACE

THE modern nurse is no longer merely the gentle attendant at the sick bed, able to perform only a few practical duties, but she is now also a watchful trained observer; of symptoms of disease, of the development of complications, and of the effects of drugs and their poisonous symptoms. In this capacity, and because of her constant presence at the bedside, she is of inestimable value to the physician in the management of the complex and often treacherous phenomena of disease.

The object of this text book is to develop intelligent, trained observers of the effects of drugs and to enable the nurse to administer medicines accurately. The majority of text books for nurses are entirely too technical, with the result that the nurse learns a great many technical terms without gaining a clear idea of the changes that drugs produce in the functions of the human body. An attempt is therefore made to present the subject in a strictly pedagogic manner, to teach facts, not words, and always to proceed from the known to the unknown. The new matter presented is based throughout upon facts previously explained. The pharmacological action is arranged in a simple, concise manner to facilitate the remembrance of the text. The numerous tables scattered throughout the book are intended to correlate the facts already learned; for example, a table of Cardiac Stimulants follows the discussion of the drugs in this group; a table of comparative actions follows that of the Atropine group, etc.

It is also essential that, before taking up the changes which drugs produce in the action of the body, the nurse have some idea of the normal action of the body. For this reason there have been scattered through the text numerous notes on Normal Physiology wherever it was felt to be necessary to a clear understanding of the drugs presented, since the arrangement of the curriculum in most training schools is such that Physiology is often studied at a later time than Materia Medica.

The nurse has ample opportunity, in the wards, to observe the effects of drugs on actual patients; but she does not benefit from this opportunity because her observation is untrained. It is to

assist and train her observation that the descriptions of the "Appearance of the Patient" are inserted in the text. This enables the nurse to compare the effects of a particular drug, given to an individual patient, with the standard description of that drug as given in the text.

Little attention is given to therapeutics; as the nurse should never treat, but administer and observe. It is occasionally important, however, that in administering certain potent drugs she should have some idea of the reason for such administration, to aid her in the observation of their effects. Short notes on the use of some of the important drugs are therefore inserted.

The chapter on "Solutions" deals with this very important subject at great length, because the proper and accurate administration of drugs, and the preparation of accurate solutions, is of prime importance to the nurse. Most of the rules for the calculation of solutions given in the text are entirely original and have been found in actual practice to be the easiest and simplest. This chapter also contains many helpful tables, such as "Saturation Points," "Usual Strengths of Standard Solutions," etc.

This book is perhaps larger than many texts on this subject but this is due to the inclusion in the text of the following features usually not dealt with: the chapter on "Solutions"; the chapter on "Prescription Reading," a subject required by most State Boards; and particularly by the inclusion, among the preparations, of most of the "New and Non-Official Remedies" in common use. Many of these substances are extensively used, and it is the nurse who has to administer them. Where is she to find the action and preparations of these drugs if not in her text book?

The classification of the drugs is based upon their therapeutic use since the nurse learns their action in this way. They are arranged in two distinct groups: "Stimulants" and "Depressants," and then according to the particular organs of the body they principally affect.

I desire to express my sincere thanks to Dr. Richard Stein and Dr. Norbert Stadtmueller for their careful examination of the proofs; and to Miss Anna L. Schulze, R. N., former Superintendent, and Miss Elizabeth P. Lindheimer, R. N., the present Superintendent of the German Hospital Training School for Nurses, New York, for valuable suggestions.

I avail myself of the opportunity to acknowledge the use, as references, of the following works: "Pharmacology and Therapeutics," by A. R. Cushny; "Therapeutics, Its Principles and

Practice," by H. C. Wood; "Essentials of Materia Medica and Therapeutics," by Henry Morris; "New and Non-Official Remedies," 1913 edition, of the American Medical Association; and to notes on the Lectures on Pharmacology delivered by Dr. W. A. Bastedo at the College of Physicians and Surgeons (Columbia University), New York.

A. S. BLUMGARTEN.

1114 Madison Ave.,
New York.

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MATERIA MEDICA FOR NURSES

CHAPTER I

INTRODUCTION

Materia Medica is the study of the substances used in treating the sick. Most of these substances are drugs, while many of them are serums, solutions of bacteria, or extracts of organs.

The subject is divided into three distinct branches.

Materia Medica proper, or **pharmacognosy,** which deals with the botanical, chemical and physical properties of drugs.

Pharmacology or pharmacodynamics, which is the study of the action, or the effects of drugs; that is, the study of the changes which drugs produce in the activities of the body, or of its organs.

Therapeutics, which deals with the treatment of disease by drugs.

For the nurse, only the first two branches of Materia Medica are of importance, as she is never called upon to treat patients, nor should she ever do so without orders from a physician. She should know, however, the properties and effects of drugs, for the physician relies upon her to see that their proper effects are obtained, and that no unusual or poisonous symptoms occur. When these do occur, she should be able to recognize them at the earliest possible moment.

Drugs are obtained from the mineral, vegetable, or animal kingdoms. Those that are obtained from the vegetable kingdom, are made from various parts of plants, such as the roots, the bark, the flowers or the fruit. In some instances the sap, or even the entire plant is used.

From the crude plant, various preparations are made, so as to be able to regulate the strength, or measure the dose of the drug more accurately; in some instances to make the drug more palatable, or to disguise its unpleasant taste.

The following is a list of the more commonly used preparations.

SOLID PREPARATIONS

Common name	Latin name	Common name	Latin name
Powder	Pulvis	Cerate	Ceratum
Pill	Pilula	Confection	Confectio
Capsule	Capsula	Ointment	Unguentum
Tablet	Tabella	Plaster	Emplastrum
Cachet	Cachet	Sterule	Sterula
Lozenge	Trochiscus	Lamella	Lamella
Vescette	Vescette	Suppository	Suppositorium
Extract	Extractum	Paper	Charta
Resin	Resina		

FLUID PREPARATIONS

Common name	Latin name	Common name	Latin name
Infusion	Infusum	Spirit	Spiritus
Fluidextract	Fluidextractum	Wine	Vinum
Tincture	Tinctura	Mixture	Mistura
Solution	Liquor	Vinegar	Acetum
Water	Aqua	Mucilage	Mucilago
Emulsion	Emulsum	Oleate	Oleatum
Syrup	Syrupus	Oleoresin	Oleoresina
Glycerite	Glyceritum	Liniment	Linimentum
Decoction	Decoctum		

DEFINITIONS OF PREPARATIONS

Solid Preparations

Powder: A crude drug ground up in the form of a powder and used in this form.

Pill: A pill is a drug moulded in the form of a very small sphere. Pills should always be fresh, for when they are exposed to the air, they may become so hard, that they cannot

be dissolved by the juices of the stomach or intestine, and they then produce no effects.

Capsule: A drug made up in a small cylindrical gelatin container which disguises the taste of the contained substance.

Tablets are dried powdered drugs which have been compressed into small discs. They are usually prepared in an aseptic manner so that they can be given hypodermically. They are very easily dissolved.

Cachets are small disc-like pieces of rice paper which are stuck together, enclosing between them the drug to be administered.

Lozenges are flat discs consisting of a drug made up with sugar or tragacanth.

Vescettes are effervescent salts compressed into a tablet.

Extract: An extract is a solid preparation obtained by dissolving the drug in alcohol or water, and then evaporating the solution. The resulting sediment is the extract, and is usually about four or five times as strong as the crude drug itself.

Resins are gummy substances which can be dissolved in alcohol, but not in water.

Cerates are preparations of drugs made up with white wax.

Confections are preparations of drugs made up to disguise the taste of unpleasant tasting substances. They are usually made up with honey and sugar.

Ointments are preparations which are applied to the skin and are melted by the heat of the body. The drugs which they contain are then absorbed by the skin. They are usually made up with lard, vaseline, or oils.

Plasters are preparations which are made up with resins, wax or lead plaster, and are then spread upon coarse muslin or white leather. They are applied to the skin, the mixture of the drugs which they contain is dissolved by the heat of the body, and the drugs are then absorbed by the skin.

Sterules are glass capsules containing a sterile solution of a drug. They are used for hypodermic administration.

Lamellae are small gelatin discs containing medicinal substances, which are inserted between the lower eyelid and the eyeball.

Papers are small pieces of paper impregnated with medicinal substances.

Suppositories are cone-shaped preparations of a drug made up with cocoa butter.

LIQUID PREPARATIONS

Infusions are preparations of plant drugs made by pouring hot or cold water over them, and then letting the drug steep for some time. The strength of an infusion depends on how much of the drug is used to a definite quantity of water.

Fluidextracts: Fluidextracts are preparations of plant drugs made by first making an extract of a drug and then dissolving this extract in alcohol or water in such quantities, that the resulting fluid contains 100% of the drug. It is therefore just as strong as the crude drug itself, but is in fluid form.

Tinctures are preparations of plant drugs, or other substances which do not evaporate easily, dissolved in a fluid other than water or glycerin. They are usually dissolved in alcohol and are now mostly 10% in strength. By a tincture, we usually mean an alcoholic solution unless the fluid in which the drug is dissolved is specially mentioned. For example, ammoniated tincture means a solution of a drug in ammonia water; while an ordinary tincture means a weak alcoholic solution.

Solutions are drugs dissolved in water. Solutions usually contain substances which do not evaporate easily.

Waters are solutions of substances which evaporate very easily.

Emulsions are solutions of oily substances which contain the oil divided up into fine globules. They are usually of a milky color and consistency.

Elixirs are palatable preparations of drugs. They are made up with alcohol, sugar and some aromatic substance. They usually contain very small quantities of the drug.

Syrups are preparations of drugs made with sugar and water.

Glycerites are preparations of drugs dissolved in glycerin.

Decoctions are preparations of plant drugs made by boiling them in water and then straining the fluid.

Spirits are preparations of volatile substances in alcohol.

Wines are preparations of drugs dissolved in wine.

Mixtures are preparations consisting either of several drugs mixed together, or a fluid containing a substance which does not dissolve.

Vinegars are medicinal substances dissolved in a weak solution of acetic acid, or vinegar.

Mucilages are gummy drugs dissolved in water.

Oleates are medicinal substances dissolved in oleic acid, which is an ingredient of many oils and fats. Oleates are more easily absorbed than ointments.

Oleoresins are extracts of plant drugs obtained by dissolving them in ether. They usually consist of a mixture of a resin, and an oil which evaporates easily (volatile oil). They are very concentrated preparations.

Liniments are liquid or soft preparations of drugs which are applied by rubbing on the skin. The drug is usually dissolved in alcohol or in an oily substance.

OFFICIAL AND UNOFFICIAL PREPARATIONS

In order that all drugs should be uniformly prepared, and a standard set for the strengths of the different preparations, a committee of physicians and pharmacists is appointed in every country to regulate the strengths and preparations of all the drugs used in medical practice. This committee publishes a book known as the Pharmacopoeia, which contains a list of all the preparations of drugs whose ingredients, strengths and methods of preparations are up to a certain standard. Such preparations are called **official preparations**, and often have the letters, U. S. P. (United States Pharmacopoeia), B. P.(British Pharmacopoeia), etc., written after them. Some preparations may be official in one

country and not in another, though they may be used in both countries.

UNOFFICIAL PREPARATIONS

Since the Pharmacopoeia committee revises the Pharmacopoeia only once in ten years, and since many drugs and preparations are discovered in the meantime, many of which may be extensively used during that time, though they are not described in the Pharmacopoeia, these drugs are called **unofficial preparations.** Many of the unofficial preparations are accepted by the Pharmacopoeia committee as being up to a certain standard in strength, ingredients and action, at their next revision, and these drugs then become **official preparations.**

Other unofficial preparations may not be accepted by the Pharmacopoeia committee, though they may be extensively used.

The National Formulary and United States Dispensatory, are private unofficial books containing a list of both official and unofficial preparations, their ingredients, preparations, and their methods of preparation.

ACTIVE PRINCIPLES

It was formerly thought that certain plants cured disease because of magic or supernatural powers which these plants possessed; and unless certain formalities were complied with, in obtaining these drugs, they were not supposed to have any curative effect.

For example, in obtaining the drug hyoscyamus (henbane) it was necessary that the drug be dug up with certain precautions, and addressed as follows:

"Sacred herb, I summon thee to the house (of my patient) to stop the Rheum of his feet, etc. I conjure thee by the great name Jaoth Sabaoth." We now know that this drug has certain active principles (the alkaloids, atropine, hyoscyamine, hyoscine) which cause its effects.

In gathering other drugs it was necessary to "Delve round the root and take it up with thy two hands turned upward;

and sing over it nine paternosters, and in the ninth, at the words 'Deliver us from evil' snap it up," etc., or it was necessary to mention the name of the sick man and his father, etc., etc.

We now know, however, that all drugs (particularly, the plant drugs) cause changes in the activity of the body by virtue of certain chemical substances which they contain. These principles contained in the plant, and which if extracted from the plant, produce the same effects as the crude drug itself, are called **active principles.**

The most important active principles are of two kinds, **alkaloids and glucosides.**

Alkaloids

An alkaloid is an active principle, found in plant drugs or made chemically, which acts like an alkali. (An alkali is a chemical substance which combines with acids to form salts. It turns red litmus paper blue). Alkaloids also combine with acids to form salts, and their salts have the same effects as the alkaloids themselves.

For example, when sodium, an alkali, is added to sulphuric acid, a salt, **sodium sulphate,** is formed.

When morphine, an alkaloid, is added to sulphuric acid, a salt, **morphine sulphate,** is formed.

The alkaloids have a definite chemical composition, but they do not dissolve readily in water. The salts which they form, however, dissolve very easily in water, and are principally used to produce the effects of the alkaloids.

Glucosides

A glucoside is the active principle of a plant drug, which, when it is decomposed into simpler substances, for example by the action of an acid, one of the simple substances thus formed is always glucose (grape sugar), or another sugar. The other substance formed is usually an aromatic substance.

Chemical Action

Drugs belonging to the mineral kingdom usually act by combining chemically with some of the body secretions, or

if they are salts, they are absorbed as such, and then they may act like an alkaloid, or physically, according to the laws of physical chemistry.

ADMINISTRATION

Drugs produce two kinds of effects; local or general effects. They may produce changes in an organ or tissue of the body if applied directly to that organ or tissue. The effect which is then produced is called a **local effect.**

They may enter the blood stream, and then affect one or a number of organs in their travels through the circulation of the blood. The effect then produced is called a **general effect.**

A drug may enter the blood stream through the skin, through the mucous membranes of various organs, such as the lungs, the stomach, the intestines or the rectum. It may be injected directly into a vein, into a muscle, or under the skin, and the drug then finds its way into the blood from these tissues.

LOCAL ADMINISTRATION

To obtain a local effect, drugs are applied in the following forms:

Solutions
Liniments
Oleates
Cerates
Powders
Lozenges
Bougies
Suppositories
Plasters
Ointments

Solutions, Oleates and Liniments are applied to various regions of the body, in the form of wet dressings. In the mouth or mucous membrane lined cavities, solutions are applied as mouth washes or irrigations.

Powders are applied directly to the surface of the body, as a spray.

Lozenges are kept in the mouth, they are dissolved by the saliva, and the medicinal substances which they contain then produce their effect.

Bougies are long thin medicated tubes, made with wax. They dissolve in mucous membrane lined cavities, and then produce either local or general effects.

Suppositories are cone-shaped preparations of drugs made with cocoa butter, and are applied in the same manner as bougies.

Plasters are usually applied on the surface of the body which is to be affected, and they are then left on for about fifteen minutes to a half hour.

Ointments are rubbed on the skin and produce either a general or local effect. For local effect they may be spread on a piece of gauze or lint and applied directly to the surface.

GENERAL EFFECTS

To produce general effects, a drug must enter the blood stream.

The most rapid way that a drug can enter the blood stream, is by being injected directly into a vein.

METHOD OF GIVING AN INTRAVENOUS INJECTION

The median basilic, or median cephalic vein of the front of the elbow is used, as the most suitable vein for injection. A rubber or gauze bandage is tightly wound around the middle of the arm, the hand is gripped firmly, and the forearm is extended. This makes the vein stand out prominently. The surface of the skin over the vein is sterilized with green soap, 50% alcohol and 1–2000 bichloride of mercury, or the site may be painted with tincture of iodine.

A hypodermic syringe (sterilized) is then filled with a sterile solution of the drug to be injected, the air is expelled from the syringe and the needle is then inserted into the vein, pointing it towards the heart, and the blood slightly aspirated from the vein. If blood is aspirated from the vein and enters the syringe you are sure the needle is in the vein.

The bandage at the arm is then loosened, and the solution of the drug is injected very slowly. It is very important to inject drugs into the vein slowly, the slower it is injected, the safer is the injection. Serious effects, at times fatal, have resulted from too rapid injections.

The effect of a drug after an intravenous injection appears immediately.

Another method of injecting a drug into the blood, is by dissolving it in normal saline solution and giving it by means of an intravenous infusion.

METHOD OF GIVING AN INTRAVENOUS INFUSION

The arm is prepared as for an intravenous injection, the fluid is prepared in a special glass jar, which is placed on a stand above the level of the patient. The fluid is then allowed to run through a rubber tube attached to either a special cannula to fit into the vein, or to a specially constructed needle. If the needle is used, it is inserted directly into the vein. If the cannula is used, the vein must be exposed, opened, and the cannula inserted into it in a direction towards the heart.

Recently a method has been devised for administering a specific drug for syphilis, Salvarsan, in this manner.

A new method of anaesthetizing patients has been recently devised, where the anaesthetic is dissolved in the saline solution and administered as an intravenous infusion.

METHOD OF GIVING AN INTRAMUSCULAR INJECTION

This is another method to cause rapid absorption and therefore rapid effects.

The sites for such injection, are usually in the buttocks, and the front of the thighs.

The skin is sterilized by washing it with green soap, alcohol and bichloride of mercury 1–2000, or it is painted with tincture of iodine. A large syringe is used with a firm needle. This is inserted perpendicularly into the skin, the syringe is then removed, or the site for injection is aspirated,

to see if the needle has been stuck into a large vessel. If blood oozes from the needle, another site must be chosen. If there is no blood oozing through the needle, the solution may be injected, **but very slowly,** and the site of injection should be thoroughly massaged afterwards. The site of injection is then covered over with collodion or some other dressing.

METHOD OF GIVING A HYPODERMIC INJECTION

The skin at the site of injection is usually sterilized with alcohol. The syringe is filled with a sterile solution of the drug to be administered, the skin is then taken up between the thumb and index finger of the left hand, and the needle is inserted **under the skin** at an angle of about forty-five degrees, and the solution slowly injected. The skin at the site of the injection is then thoroughly massaged.

Care must be taken to insert the needle under the skin, not into the skin, in which case the skin looks like goose skin, and the needle should be withdrawn.

The best sites for injections, are the front of the thighs, the arms and forearms.

The effects appear in about ten minutes to a half hour after injection, depending on how good the patient's circulation is.

METHODS OF GIVING DRUGS FOR ABSORPTION FROM THE SKIN

To administer drugs for absorption from the skin, it is necessary to rub the drug thoroughly on the skin in such a manner that it will not evaporate very easily. For this purpose ointments are used. These must be rubbed thoroughly over a large surface, to get the greatest amount of absorption. As the pores of the skin become clogged up with the ointment after continued use, the ointment is usually rubbed in a different region of the body every day. For example, on one thigh one day, on the other, the next day; then it is rubbed on the arms, then on the chest, finally on the back.

This is called a course of rubbings, or inunctions. In applying potent drugs in the form of rubbings, the nurse should protect her hands from absorbing the drug by using old kid gloves, or by rubbing the ointment with a piece of chamois.

Another method of applying drugs to the skin for absorption is by means of vapor. The patient sits in a closed cabinet, the head protruding from the top, while underneath the chair the drug to be given is burnt, the fumes being absorbed by the skin.

INTERNAL ADMINISTRATION

The most common way of administering drugs, however, is to let the patient drink or swallow them. The drug is dissolved in the stomach or intestines, if it is not already in a fluid form. It is then absorbed by the mucous membrane of the stomach or intestine, and enters the blood stream in this manner.

Many drugs are given by the rectum, in cases where it may not be possible, or when it is harmful to give them by the stomach. In such cases they are given in the form of suppositories, which are inserted into the rectum, the cocoa butter dissolves, and the contained drug goes through the mucous lining of the rectum into the blood stream.

Drugs may also be given by a rectal enema, or even better, by allowing it to run in drop by drop in saline solution through a catheter attached to an apparatus arranged at the side of the bed, the pressure of which can be easily regulated (Murphy Method).

TIME OF ADMINISTRATION

With some exceptions, it is not of very great importance whether a drug is given before or after meals.

As a rule, drugs which increase the appetite or which increase the secretion of the stomach or intestines should be given before meals.

Those that are given to neutralize excessive secretions

in the stomach, or those that are harmful (irritating) to the stomach should be given after meals.

DOSAGE

All drugs are poisons—they are harmful to the individual; in fact they may even cause death if given in sufficiently large quantities.

The harm to the individual is done by causing an over-activity of some, or of all the organs of the body (over stimulation, irritation), or by lessening the activity of an organ or several organs to a very marked degree (depression). It is by taking advantage of these activities of drugs, that they can be used in the treatment of disease. The difference, however, between beneficial and poisonous or dangerous effects, is simply due to the difference in the amount of drug that is used.

By experiments on animals, it can be determined how little of a drug can be given in order to produce any change in the activity of an organ, or the activity of the body:—such an amount is called the **minimum or smallest dose.** By similar experiments we can find out how large an amount of a drug can be given without producing any dangerous effects. This amount is called **the maximum dose.** If larger quantities than the maximum dose are given, we get poisonous or dangerous symptoms—such a dose is called an **overdose,** or **poisonous dose.**

The doses of different drugs are different; some drugs may be found to have accidentally the same dose.

Conditions Influencing the Dose of a Drug

There are certain conditions which influence the dose of a drug.

(1) **Age:** An older person usually needs a larger dose than a younger one.

(2) **Sex:** Males usually require larger doses than females.

(3) **Weight:** Heavier, stouter individuals, usually require larger doses than lighter individuals.

(4) **Temporary Conditions:** After a meal there is usually

less absorption than before, the effects are therefore not as marked.

(5) **Time of Administration:** For example, some drugs, such as those which produce sleep, may produce little effect in the morning, and more marked effect in the evening.

(6) **Pregnancy, Lactation,** and **Menstruation** are factors which occasionally cause changes in the activity of certain drugs.

Young's Rule for Dosage

To determine the dose of a drug to be administered to a child, we fill in the known amounts in the following formula, and then calculate it. The result is the fraction of the adult dose to administer.

Young's Rule: Age of the child, divided by (age + 12) = the fraction of the adult dose, or

$$\frac{\text{age}}{\text{age} + 12} \text{ of adult dose.}$$

For potent drugs, a slightly smaller quantity should be administered, and for some drugs a slightly larger dose should be administered.

Example: How much Aspirin should be given to a child of 3 years old. Adult dose of Aspirin = grs. 5

Age of child = 3

$$\text{then, } \frac{3}{3 + 12} = \frac{3}{15} = \frac{1}{5}$$

We therefore give the child $\frac{1}{5}$ of (grs. 5) or gr. 1 of Aspirin.

IDIOSYNCRASY

There are some individuals who get unusual or opposite effects, others who get even poisonous effects, from ordinary doses of some drugs. There are others, upon whom even larger doses of some drugs produce no effect at all. Such people are said to have an **idiosyncrasy** against a particular drug.

There are two kinds of idiosyncrasies.

(a) **Idiosyncrasy of Effect:** Those that get opposite, unusual or poisonous effects from small or ordinary doses of drugs.

(b) **Idiosyncrasy of Dose:** Individuals who get no effect at all from ordinary, or even large doses of certain drugs.

For example, morphine is a drug which usually produces sleep and quiets the patient. There are some people in whom it may cause excitement and keep them awake.

Another example, is one in whom even larger doses of morphine produce no effect at all.

CHAPTER II

SYSTEMS OF MEASUREMENT

There are two systems of measuring drugs. One is the French or Metric System, the other is the English or Apothecaries' System.

The Metric System is the one which is used in all European countries, and has the advantage, that the units are divided into tenths, that the units of length, volume and weight are similar, and that the units of volume are equal to the units of weight.

In this country, the Apothecaries' System is still used, but it is gradually being superseded by the Metric System, and it is simply a question of time when the Apothecaries' System will be abandoned entirely.

THE METRIC SYSTEM

The elementary unit of measurement in the Metric System is the one for length. This is the **meter,** which is about one ten-millionth part of the distance from the equator to the north pole. It is equal to about 39.37 inches and is written as 1.0

TABLE OF LENGTH

The unit is	1.0	one meter
one tenth of it is	0.1	one decimeter
" " " " "	0.01	one centimeter
" " " " "	0.001	one millimeter

TABLE OF SURFACE

A surface one meter long and one meter wide is called **a** square meter 1.0 sq. m.

The unit is	1.0	one square meter
one tenth of it is	0.1	one square decimeter
" " " " "	0.01	one square centimeter
" " " " "	0.001	one square millimeter

TABLE OF VOLUME

A volume one meter long, one meter wide, and one meter high, is one cubic meter.

1.0	one cubic meter
0.1	one cubic decimeter
0.01	one cubic centimeter
0.001	one cubic millimeter

TABLE OF WEIGHTS

The unit of measurement for weight, is the **gramme**, which is the weight of one cubic centimeter of water at a temperature of 4 degrees centigrade, written

	1.0	one gramme
one tenth of it is	0.1	one decigramme
" " " " "	0.01	one centigramme
" " " " "	0.001	one milligramme

Units greater than one gramme are given definite names.

ten times	1.0	1 gramme
is equal to	10.0	1 decagramme
ten times that is	100.0	1 hectogramme
" " " "	1000.0	1 kilogramme

Since 1.0 (one gramme) is the weight of 1 cubic centimeter of water, in referring to fluids, we call the denomination 1.0, one cubic centimeter; 2.0, two cubic centimeters (2 c.c.), etc.

TABLE OF CAPACITY

For measuring fluids, the unit of measurement is the **litre**, which is the amount of water at 4 degrees centigrade contained in a volume of one cubic decimeter, or the capacity of one kilogramme of water at 4 degrees centigrade.

One litre = 1000 grammes, or since 1000 grammes occupies 1000 cubic centimeters of space

One litre = 1000 c. c. which is the unit of capacity

One tenth of that is					1 decilitre =	100	c.c. or 1 hectogramme.
"	"	"	"	"	1 centilitre =	10	c.c. or 1 decagramme.
"	"	"	"	"	1 mililitre =	1	c.c. or 1 gramme.

The terms deca, hecto and kilo, we apply to quantities ten, one hundred or one thousand times respectively greater than the litre.

To overcome the difficulty of remembering the denominations of the Metric System, it will be facilitated, if we remember that the figures to the **left** of the decimal point, correspond to **dollars,** in our coinage system; and to **grammes** in the Metric System. The figures to the **right** of the decimal point, correspond to dimes, cents and mills respectively, in our coinage system, and to **decigrammes, centigrammes and milligrammes** in the Metric System.

For example: $1.53 is one dollar and fifty-three cents in our coinage system, and if we write it without the dollar sign, in the Metric system of Measuring Weights, we call it, one gramme and fifty-three centigrammes.

APOTHECARIES' WEIGHT MEASUREMENT

The unit of measurement is the **grain,** which is equal to 0.065 (sixty-five milligrammes) in the Metric System. The grain is written gr. i.

20 grains	= one scruple ℈
3 scruples or 60 grains	= one drachm ʒ
480 grains or 8 drachms	= one ounce ℥
5760 grains or 12 ounces	= one pound lb.

FLUID MEASUREMENT

Table of Capacity

The unit of measurement is the **minim,** which is equal to 0.065 cubic millimeter. It is written m i.

60 minims	= one fluid drachm ʒ
8 fluid drachms	= one ounce ℥
16 ounces	= one pint ○
2 pints	= one quart qt.
4 quarts or 8 pints	= one gallon gal.

TABLE OF EQUIVALENTS

Value of Metric Units in Apothecaries' Units

	Grain	Drachm	Ounce	Pound
One milligramme . . .	0.01543	0.00026	.....	.....
One centigramme . . .	0.15432	0.0026	0.00032	.....
One decigramme	1.54324	0.0257	0.0032	0.00027
One gramme	15.43236	0.257	0.03215	0.00270
One kilogramme	15432.3564	257.206	32.1508	2.6792

APPROXIMATE EQUIVALENTS OF METRIC UNITS

Weight

One milligramme = $\frac{1}{64}$ of a grain
One centigramme = $\frac{1}{6}$ of a grain
One decigramme = $1\frac{1}{2}$ grains
One gramme = $15\frac{1}{2}$ grains
(in prescriptions 15 grains)
One kilogramme = 32 ounces or $2\frac{2}{3}$ pounds

Capacity

One cubic millimeter c. m. m. = $1\frac{1}{2}$ minims
One cubic centimeter c. c. = 15 minims
One litre = 34 ounces or $2\frac{1}{9}$ pints (or approximately) one quart

APPROXIMATE EQUIVALENTS OF APOTHECARIES' UNITS

Weight

One grain = 0.06 (six centigrammes)
One drachm = 4.0 (4 grammes)
One ounce = 30.0 (30 grammes)

Capacity

One minim = 0.06 of a cubic centimeter
One drachm = 4.0 c.c. (4 cubic centimeters)
One ounce = 30.0 c.c. (30 cubic centimeters)
One pint = 500.0 c.c. (500 cubic centimeters)
One quart = 1000.0 c.c. (one litre)

APPROXIMATE EQUIVALENTS OF METRIC UNITS COMMONLY USED IN PRESCRIPTIONS

2.0	(2 grammes)	= 30	grains
1.0	(1 gramme)	= 15	grains
0.6	(6 decigrammes)	= 10	grains
0.3	(3 decigrammes)	= 5	grains
0.2	(2 decigrammes)	= 3	grains
0.1	(1 decigramme)	= $1\frac{1}{2}$	grains
0.06	(6 centigrammes)	= 1	grain
0.03	(3 centigrammes)	= $\frac{1}{2}$	grain
0.015	(15 milligrammes)	= $\frac{1}{4}$	grain
0.008	(8 milligrammes)	= $\frac{1}{8}$	grain
0.004	(4 milligrammes)	= $\frac{1}{16}$	grain
0.0032	(32 decimilligrammes)	= $\frac{1}{20}$	grain
0.0027	(27 decimilligrammes)	= $\frac{1}{25}$	grain
0.0022	(22 decimilligrammes)	= $\frac{1}{30}$	grain
0.0016	(16 decimilligrammes)	= $\frac{1}{40}$	grain
0.0013	(13 decimilligrammes)	= $\frac{1}{50}$	grain
0.0011	(11 decimilligrammes)	= $\frac{1}{60}$	grain
0.001	(1 milligramme)	= $\frac{1}{64}$	grain
0.0006	(6 decimilligrammes)	= $\frac{1}{100}$	grain
0.0005	(5 decimilligrammes)	= $\frac{1}{120}$	grain
0.0004	(4 decimilligrammes)	= $\frac{1}{150}$	grain
0.0003	(3 decimilligrammes)	= $\frac{1}{200}$	grain
0.0001	(1 decimilligramme)	= $\frac{1}{600}$	grain

PRACTICAL MEASUREMENT OF UNITS

To measure the Minim m i or 0.06 (6 centigrammes)

The minim is not exactly equal to the drop. There are many medicine droppers in practical use, from which each drop that is expelled, is approximately equal to **one minim.**

By a drop, is usually meant the drop which falls from the mouth of a bottle when it is held horizontally. **Two or two and a half** of such drops, are approximately equal to **one minim.**

To measure the Drachm ℥i or 4.0 (4 grammes)

The **Drachm** is equal to a **level teaspoonful** of either a fluid or a solid preparation.

Two drachms or 8.0 (8 grammes) are contained in a **level dessertspoonful.**

Four drachms, or half an ounce, or 16.0 (16 grammes) are equal to a **level tablespoonful.**

Eight ounces, or 240.0 (240 grammes) are contained in **a full tumbler.**

TABLE OF APPROXIMATE EQUIVALENTS

One drachm or	4.0 (4 grammes)	= one teaspoonful
Two drachms or	8.0 (8 grammes)	= one dessertspoonful
Four drachms or	16.0 (16 grammes) half an ounce	= one tablespoonful
Eight ounces or	240.0 (240 grammes)	= one tumblerful

METHOD OF REDUCING METRIC DENOMINATIONS TO APOTHECARIES' DENOMINATIONS

Rule 1. Multiply the Metric quantity by 15; which gives the number of grains or minims, and reduce the result to its lowest terms.

(Since 1.0 is equal to 15 grains or 15 minims)

Example: Reduce 1.03 (1 gramme and 3 centigrammes) to the Apothecaries' denominations.

Since **1.0** = 15 grains

1.03 = 15 × 1.03 = 15.45 grammes $15\frac{45}{100} = 15\frac{1}{2}$ grs.

Example: Reduce 64.0 gms. to its Apothecaries' equivalent.

Since 1.0 = 15 grains

64.0 = 64 × 15 = 960 grains

Since there are 480 grains in one ounce, in 960 grains there are 960 ÷ 480 = 2 ounces, written ℥ii

Rule 2. To reduce very small Metric quantities (less than 0.06) to their Apothecaries' equivalents.

Write the Metric quantity as the numerator of a fraction, of which the denominator is always 0.06 (six centigrammes), and reduce the fraction to its lowest terms. The result is the fraction of a grain.

Example: Reduce 0.0004 (4 decimilligrammes) to its Apothecaries' equivalent.

Since 0.06 (six centigrammes) is equal to 1 grain,
0.0004 (4 decimilligrammes) is equal to

$$\frac{0.0004}{0.06} \text{ of a grain} =$$

$$\frac{00004}{00600} = \frac{4}{600} = \frac{1}{150} \text{ grain.}$$

0.0004 (4 decimilligrammes) is equal to $\frac{1}{150}$ grain.

METHODS OF REDUCING APOTHECARIES' UNITS TO THEIR METRIC EQUIVALENTS

Rule 1. Reduce the quantity to grains and divide the result by 15. The result is the number of grammes.

Since 15 grains = 1.0 (1 gramme)

Example: Reduce 2 drachms ʒii to their equivalent Metric units.

2 drachms = 2 × 60 or 120 grains
120 ÷ 15 = 8
ʒii, 2 drachms = therefore, 8 grammes

When larger quantities are dealt with, the following method is easier.

Rule 2. Reduce the quantity to drachms and multiply by 4.

Since 1 drachm = 4.0 (4 grammes)

Example: Reduce 5 ounces ℥v to its metric equivalent.

Since 1 drachm = 4.0 (4 grammes)
5 ounces therefore = 160.0 (160 grammes)

Rule 3. Another simple method of reducing Apothecaries' units to Metric Units, is to reduce the quantity to grains and multiply the result by 0.065 (65 centigrammes).

(Since 1 gramme = 0.065)

Example: Reduce 1 drachm and a half ʒiss to its metric equivalent.

One drachm and a half = 90 grains
Since one grain = 0.065, 90 grains will equal
$90 \times 0.065 = 5.85$ (5 grammes and 85 centigrammes)

Rule 4. For very large quantities reduce the amount to ounces and multiply the result by 30.

Since one ounce = 30.0 (30 grammes)

Example: Reduce 40 ounces to its metric equivalent.

Since one ounce = 30.0 (30 grammes)
40 ounces = $40 \times 30.0 = 1200.0$ grammes.

Rule 5. To reduce fractional amounts of Apothecaries' units to their metric equivalents, multiply the fraction by 0.06 (six centigrammes), and divide the denominator into the numerator.

The result is the number of grammes the fraction is equal to.

Example: Reduce $\frac{1}{100}$ grain to its metric equivalent.

Since 1 grain = 0.06 (six decigrammes)

$$\frac{1}{100} \text{ grain} = \frac{1}{100} \times 0.06 = 100 \overline{)0.06} \quad 0.0006$$

$\frac{1}{100}$ grain = 0.0006 (six decimilligrammes).

Example: Reduce $\frac{1}{250}$ grain to its metric equivalent.

Since 1 grain = 0.06

$$\frac{1}{250} \text{ grain is equal to } \frac{1}{250} \times 0.06 = 250 \overline{)0.06} \quad 0.00028$$

$\frac{1}{250}$ grain = 0.00028 (28 centimilligrammes).

CHAPTER III

PRESCRIPTION READING

It is important for the nurse to be able to read prescriptions, as she is occasionally ordered to administer a medicine, the ingredients of which are written in the form of a prescription.

Every prescription consists of four parts:

1. **The Superscription**
2. **The Inscription**
3. **The Subscription**
4. **The Signature**

1. **The superscription** consists of the date, and the name of the patient, which are written at the top, (occasionally the name of the patient is written at the lower right hand corner) and the symbol ℞ which stands for the Latin word RECIPE, meaning "take thou." It is also a symbol of the God Jupiter, and is a relic of the days, when all prescriptions were begun with a prayer to Him, invoking His divine aid in making the ingredients more efficacious.

2. **The inscription** consists of the names and the amounts of the ingredients used.

The names are written in Latin, usually in the genitive case, for example, Camphora (genitive, Camphorae).

The most important ingredient in the prescription is written first, and is often called the **basis.**

The next most important ingredient is called the **adjuvant,** and is written next.

The next substance written, is usually the one which disguises the taste of the mixture, such as a syrup, and is often called the **corrigent** or **corrective.**

The last substance written, is the one in which all the

others are dissolved, and it is often called the **vehicle, excipient** or **menstruum.**

The amounts of the ingredients are written in the Metric or Apothecaries' system of measurement.

In the metric system, the units used are the gramme, decigramme, centigramme, milligramme, etc.

In the apothecaries' system, the units used are the drachm, grain, minim, etc. They are written in the Arabic symbols. Roman numerals being used however, for the numbers, unless the quantity is a fraction, in which case the Arabic numerals are used.

Example

ℨv	=	5 drachms
grs. xx	=	20 grains
℈ix	=	9 scruples
℥i or ℥j	=	1 ounce
♎iii	=	3 pints
ℨss	=	½ drachm
gr. $_{1}\frac{1}{0\,0}$	=	$_{1}\frac{1}{0\,0}$ grain

The abbreviation ss is for the Latin word semis, meaning half.

3. The **subscription** consists of the directions to the druggist for compounding the prescription. These are usually written in Latin.

Certain abbreviations are commonly used in the subscription. The most common ones are

q. s. = quantum sufficit (as much as may be necessary)
q. s. ad = quantum sufficit ad (as much as may be necessary to)
m. = misce (mix)

F. fiat. (singular) used when only one ingredient is written. F. fiant (plural) when many ingredients are used.

F.	= fiat.	= make
D.	= dentur	= give
Div.	= divide	= divide
caps.	= capsulas	= capsule
pil.	= pilulas	= pill
chart.	= chartas	= powder
tab.	= tabellas	= tablet

tab. trit.	= tabellas triturates	= tablet triturates
troch.	= trochisci	= lozenges
supposit.	= suppositoria	= suppositories
	tales	= such
dos.	= doses	= doses
ad. scat.	= ad scatulam	= in the box
	pone in scat.	= put in a box
	cochleare	= spoon
	cochleare parve	= teaspoon

The following are the most common Latin verbs used in prescriptions.

adde	= add
bulliat	= boil
cola or colator	= strain
filtra	= filter
solve	= dissolve
tere	= rub
tere bene	= rub well

The following are the most common adjectives used

	aequalis	= equal
aa.	= partes aequalis	= equal parts
	bulliens	= boiled
	fervens	= hot
	saturatus	= saturated
	magnus	= large
	parvus	= small

The **signature** is usually written at the end of the prescription and consists of the directions to the patient. It always begins with the abbreviation S. meaning signa = mark (on the label).

The quantities to be administered are written in their Metric or Apothecaries' equivalents, for example, a teaspoon is written 4.0 or ʒi.

A dessertspoon, is written 8.0 or ʒii.

The following are the abbreviations used in the signature, and their definitions.

It is important for the nurse to know them, as her orders are often written with these abbreviations.

gtt.	= gutta	= drop
A. M.	= morning	
P. M.	= evening	
o. d.	= omne die	= daily
o. m.	= omne mane	= every day
o. n.	= omne nocte	= every night
m. et. n.	= mane et nocte	= day and night
t. i. d.	= ter in die	= 3 times a day
b. i. d.	= bis in die	= twice a day
q. i. d.	= quatuor in die	= four times a day (not to be given at night)
q. h.	= quaqua hora	= every hour
q. 2 h.	= quaquae duo horae	= every 2 hours
q. 3 h.	= quaquae tres horae	= every 3 hours

When medicines are ordered to be given q. 2h. or q. 3h. etc. they must always be given at night also.

stat.	= statum	= at once, immediately
s. o. s.	= si opus sit	= if necessary

This refers to only one dose. More than one dose should not be given if a medicine is ordered s. o. s.

p. r. n.	= pro re nata	= when required (as often as necessary)

When a drug is ordered p. r. n. the nurse may use her judgment in giving more than one dose.

a. c.	= ante cibum	= before meals
p. c.	= post cibum	= after meals

At the end of the prescription, the physician's name is written.

EXAMPLES OF PRESCRIPTIONS OF FLUID MEDICINE

May 17, 1905

For Mr. John Jones

℞

Magnesii Sulph.	ʒii
Magnesii Carb.	
Spiritus Ammoniae Aromat. āā	ʒi
Aqua destil. q. s. ad.	℥i

M. et. Sig. ʒi t. i. d.

Dr. Brown

In this prescription, the superscription is the ℞ and Mr. John Jones.

The inscription is the mixture of the ingredients, of which the magnesium sulphate is the most important, magnesium carbonate next of importance, while the distilled water is the excipient or menstruum.

The directions to the pharmacist are simply to mix the ingredients together (misce); and the directions to the nurse to administer one teaspoonful of it three times a day (t. i. d.).

May 5, 1904

For Mr. Bates

℞

Bismuthi Subnitr.	15.0
Mucilago Acaciae	10.0
Syr. Simplex	5.0
Aqua Cinnamomi q. s. ad.	60.0

Misce et. Sig. ℥i q. i. d.

Dr. Jameston

This prescription reads:

For Mr. Bates.—

Take thou, of bismuth subnitrate 15 grammes, of mucilage of acacia 10 grammes, of simple syrup, 5 grammes, and add enough cinnamon water to make up 60 grammes. Mix the ingredients together and give the patient one teaspoonful of the mixture three times a day.

This is a very good method of prescription writing.

If the mixture is made up in a two ounce bottle, the number of grains of each ingredient, in every teaspoonful, is the same as the number of grammes of each ingredient in the entire mixture; since there are 60 grains in each drachm or teaspoonful dose, and there are 60 grammes in a two ounce bottle.

For Example: In the above prescription we can see at once that each teaspoonful dose of the mixture contains 15 grains of bismuth subnitrate, 10 grains of mucilage of acacia, etc.

Example

June 5, 1900

For Mr. Winsley

℞

Extracti Colocynthidis Compositi ʒss
Rheii grs. xxiv
m. et divide in pilulae No. XII
Sig. one o. n.

Dr. Jamestain

This prescription reads:
Take thou, of compound extract of colocynth 2 drachms, and of rhubarb 24 grains, mix them together, and divide the mass into twelve pills. Each pill therefore contains $\frac{1}{12}$ of the whole amount, or 10 grains of the compound colocynth powder and 2 grains of the rhubarb.

Example

April 7, 1899

For Mr. Hestar

℞

Tab. Morphinae Sulph. aa 0.015
D. tales dos. No. XX

Dr. Sesley

This prescription reads, take thou of morphine sulphate tablets, each to contain 0.015 (15 milligrammes). Give twenty such doses.

Example

May 17, 1895

For Mr. Hillston

℞

Pyramidon 0.1
Phenacetine 0.2
Caffeine 0.06
Sacch Lact. 0.3
D. tales dos. No. XX et. pone in scat.
M. et. fiant. in chart.
Sig. one t. i. d.

Dr. Lestertan

This prescription reads:

Take thou, of pyramidon 1 decigramme, of phenacetine 2 decigrammes, of caffeine 6 centigrammes, and of milk sugar 3 decigrammes. Mix the ingredients together into a powder, and put twenty such powders in a box. Give one three times a day.

CHAPTER IV

SOLUTIONS

A solution is a liquid containing particles of a solid, gas or another liquid, so finely divided, that this dissolved substance cannot be seen, and the fluid seems to be of one color and consistency.

A substance may be dissolved in water, alcohol, ether, glycerin, etc. They are then called alcoholic, ethereal solutions etc. (see preparations).

By the **strength** of the solution is meant, the amount of a substance that is dissolved in the fluid. For example—by a five per cent silver nitrate solution, we mean that 100 parts of a certain fluid contain five parts of silver nitrate, (5 grammes of silver nitrate for every 100 grammes of water). The strength of a solution is often spoken of as a 1 to 1000 or 1 to 1500 solution.

In the Apothecaries' System, we often speak of the strength of a solution as the number of grains to the ounce. For example—a solution of zinc sulphate containing five grains to the ounce, etc.

SATURATION

When a fluid contains as much solid or gaseous matter as it can hold, it is said to be saturated with that substance. Such a solution is called a **saturated solution.** If more of that substance is added to the solution, it will not be dissolved, but remain undissolved as a sediment.

The saturation point of different substances, varies; with some it is 5%, with others 50%, with others 100% etc.

The strength of a saturated solution varies with the fluid in which a substance is dissolved. For example: the saturation point of silver nitrate in water is 65%, in alcohol it is 4%.

TABLE OF SATURATION POINTS OF COMMONLY USED SOLUTIONS FOR LOCAL USE

Name of Solution	Sat. Point in Water	Sat. Point in boiling Water	Sat. Point in Alcohol	Sat. Point in Glycerin
Alum	10%	80%	insoluble	freely when warm
Benzoic Acid	0.4%	6%	30%	....
Bichloride of Mercury	7%	33%	25%	7%
Boric Acid	5%	25%	7%	20%
Carbolic Acid	8%	All proportions	All proportions	All proportions
Cocaine	0.2%	Decomposed	17%	....
Cocaine Hydrochloride	70%	Decomposed	40%	....
Gallic Acid	1%	25%	20%	8%
Lead Acetate	30%	50%	3%	....
Potassium Bicarbonate	25%	Decomposed	insoluble	....
Potassium Carbonate	50%	70%	insoluble	....
Potassium Chlorate	6%	40%	slightly soluble	....
Potassium Permanganate	6%	25%	Decomposed	....
Silver Nitrate	65%	90%	4%	....
Sodium Borate	5%	66%	insoluble	50%
Sodium Bicarbonate	8%	Decomposed	insoluble	....
Sodium Carbonate	25%	35%	insoluble	....
Sodium Chloride	26%	30%	insoluble	....
Tannic Acid	75%	very soluble	30%	....
Zinc Sulphate	65%	83%	insoluble	....

TABLE OF SATURATION POINTS OF COMMONLY USED SOLUTIONS FOR INTERNAL ADMINISTRATION

Name of Solution	Sat. Sol. in Water	Sat. Sol. in boiling Water	Sat. Sol. in Alcohol	Sat. Sol. in Glycerin
Ammonium Carbonate..	20%	Decomposed	....	....
Ammonium Chloride...	33%	50%	2%	17%
Ammonium Bromide...	45%	53%	7%	....
Ammonium Iodide.....	62%	70%	10%	....
Calcium Oxide.....	0.1%	0.06%	insoluble	....
Hydriodic Acid.....	10%	All proportions	All proportions	....
Lithium Bromide.....	62%	70%	very soluble	....
Magnesium Sulph.....	54%	88%	insoluble	....
Methyl Salicylate	slightly	very	very	....
Potassium Acetate.....	71%	More soluble	33%	....
Potassium Bicarbonate.	25%	Decomposed	insoluble	....
Potassium Bitartarate..	0.5%	5%	slightly	....
Potassium Bromide....	50%	50%	0.5%	....
Potassium Citrate.....	66%	very	slightly	....
Potassium Iodide	100%	100%	8%	30%
Potassium and Sodium Tartarate.....	45%	50%	insoluble	....
Quinine Bisulphate.....	10%	Decomposed	5%	5%
Quinine Hydrochloride..	100%	Decomposed	62%	11%
Quinine Salicylate	1%	Decomposed	8%	6%
Quinine Sulphate.....	0.1%	Decomposed	1%	3%
Salicylic Acid	0.3%	6%	33%	....
Sodium Acetate.....	50%	All proportions	4%	....
Sodium Bicarbonate....	8%	Decomposed	insoluble	....
Sodium Citrate.....	50%	71%	slightly	....

TABLE OF SATURATION POINTS OF COMMONLY USED SOLUTIONS FOR INTERNAL ADMINISTRATION—*Continued*

Name of Solution	Sat. Sol. in Water	Sat. Sol. in boiling Water	Sat. Sol. in Alcohol	Sat. Sol. in Glycerin
Sodium Bromide.....	50%	55%	7%	....
Sodium Iodide.....	100%	100%	25%	....
Sodium Salicylate.....	55%	very soluble	15%	....
Strontium Bromide.....	50%	70%	very soluble	....
Sodium Sulphate.....	26%	Decomposed	insoluble	soluble
Sodium Phosphate.....	15%	Decomposed	insoluble	....

RULES FOR MAKING SOLUTIONS

The nurse is often called upon to make up solutions of drugs, differing in strength from those she has in stock, or to administer doses of drugs from stock solutions of various strengths.

The following rules are methods for calculating the amounts to be used. These methods are based upon simple arithmetic, and are of great assistance in making up accurate solutions, or to administer an accurate dose of a drug.

RULES FOR MAKING UP SOLUTIONS OF DIFFERENT STRENGTHS FROM STOCK SOLUTIONS OF KNOWN STRENGTHS

Rule 1. To find out in how much water to dissolve a tablet of known strength to make up a solution of a required strength.

Example: In how much water would you have to dissolve a 0.3 gm. tablet (grs. 5) of bichloride of mercury, to make up a solution of 1–2000 strength.

Let X = the number of cubic centimeters of water to be used; then the tablet has the same proportion to the number

of cubic centimeters of water to be used, as 1 is to 2000, or, writing it in the form of a proportion,

$$0.3 : X :: 1 : 2000$$

In any proportion the outer numbers are called extremes, and the inner numbers are called means.

The extremes in this example are 2000 and 0.3
" means " " " " X and 1

Since in any proportion, **the product of the means is always equal to the product of the extremes,**

we find that the number of c.c. or
$X = 0.3 \times 2000 = 600.$ cubic centimeters

We would have to dissolve the tablet in about 600 cubic centimeters of water, or approximately one pint.

Therefore, to find out the number of cubic centimeters of fluid in which to dissolve a tablet of known strength, we write the example in the following manner.

The tablet in stock, is to the amount of water to be used, (represented by X) as the proportion of the drug to water in the required strength, or

Tablet : X :: drug : water (in required strength)
X being the amount of water to be used

Example: How much water is to be used in making up a solution of 1–5000 bichloride of mercury with a tablet of bichloride of mercury of 7½ grains.

1. Reduce grs. 7½ to its metric equivalent
Since gr. i = 0.06 (six centigrammes)
7 ½ grs. = 7½ × 0.06 = 0.45 (centigrammes)

then

0.45 : X :: 1 : 5000
X = therefore 0.45 × 5000 = 2250 cubic centimeters
2250 cubic centimeters = 2 quarts and half a pint
(1000 cubic centimeters = 1 quart)

Rule 2. To find out the quantity of drug to be used to make up a required amount of a given strength of solution.

Rule: The amount of drug to be used (represented by X) has

the same proportion to the known quantity to be made up, as the proportion of drug is to water in the required strength, or, writing this formula in the form of a proportion,

X (the amount of drug to be used): the quantity to be made up:: the amount of drug: water (in the required strength)

Example: How much potassium chlorate would be necessary to make up one pint of a 4% potassium chlorate solution.

One pint = 500 cubic centimeters, 4% = 4 : 100
Let X = the amount of drug to be used, then
X : 500 :: 4 : 100

Again, the product of the extremes is equal to the product of the means.

Extremes are, 100 and X
Means are 4 and 500
therefore, 100 X = 4 × 500, or 2000
or X = 20 grammes

20 grammes of potassium chlorate would then have to be added to 500 grammes of water (1 pint) to make up a 4% solution.

In the above examples, it is important to reduce all the quantities used, to the metric units; as apothecaries' units cannot be multiplied by metric units. For example, it is impossible to multiply grains by grammes or cubic centimeters.

The problems can be worked out in the apothecaries' units if all the known quantities are reduced to the same apothecaries' unit.

Example: How much boric acid would be necessary to make up one quart of a 2% solution.

1. Reduce all the quantities to the apothecaries' units, preferably to grains or minims.

One quart = 15360 minims

A 2% solution is approximately 10 grains to the ounce (480 grains equals one ounce). A 2% solution is approximately 10 : 500 or 1 : 50 then

Let X = the number of grains to be used, then
X : 15360 :: 1 : 50 or
50 X = 15360 grains
X = 50 | 15360
307 grains
307 grains = 5 drachms (since 1 drachm = 60 grains)

To find the amount of water to be used in Rule 1, (in the apothecaries' units), the same method may be used, reducing the known quantities to their apothecaries' units, however. It is much simpler however, to reduce the known quantities to the metric units, and solve the problem as shown in examples 1 and 2.

Rule 3. To find the amount of a stock solution of known strength to use in making up a solution of a known different strength.

Example: How much of a 1% bichloride of mercury solution must be used to make up 500 c.c. or 1 pint of a 1 to 2000 solution. The stock solution in this problem is the 1% bichloride of mercury solution.

If we represent the amount of stock solution to use by X, then the amount of drug to be used, has the same proportion to the amount of solution to be made up, (in this case 500 c.c.) as the proportion of drug to water in the required strength (in this case 1 to 2000); since the 500 c.c. must contain 1 part of bichloride of mercury to 2000 c.c. of water.

This example, written in the form of a proportion is:

$$X : 500 :: 1 : 2000$$

This proportion would be true, if the stock solution were of full strength or 100%; but since it is only a 1% solution and contains only $\frac{1}{100}$ part of the drug, the amount of stock solution is only $\frac{1}{100}$ of X, then the proportion is:

$$\frac{1}{100} X : 500 :: 1 : 2000$$

In this proportion the means are 1 and 500, and the extremes, $\frac{1}{100}$ X, and 2000.

Since in every proportion, the product of the means is always equal to the product of the extremes, then,

$$\frac{1}{100} X \times 2000 = 500 \times 1$$

$$\text{or } X = \frac{1}{2000} \times \frac{100}{1} \times 500 \times 1$$

(Since, when we divide an equation or proportion by the numbers on one side of the equation, these numbers become inverted on the other side; thus 2000 becomes $\frac{1}{2000}$, $\frac{1}{100}$ becomes $\frac{100}{1}$, etc.

$$\text{Therefore } X = \frac{100}{4} = 25$$

25 c.c. of the 1% solution of bichloride of mercury will then have to be added to 500 c.c. of water to make up the 1 to 2000 solution.

To make the calculation of the amount easier, however, we find by this method of proportion, that X, or

The amount of stock solution to use, in making up a definite quantity of one solution from another, is always equal to:

The strength of the required solution, written as a fraction (in terms of a hundred) multiplied by the strength of the stock solution, also written as a fraction, (in terms of a hundred) but inverted, multiplied by the number of cubic centimeters to be made up.

The result is the number of cubic centimeters of the stock solution to add to the required amount of water.

All the known quantities however, must be reduced to their metric equivalents.

Example: How much of a 5% solution of bichloride of mercury will have to be used to make up 1000 c.c. (one quart) of a 1–2500 solution.

The required solution is 1 : 2500

Written as a fraction it is $\frac{1}{2500}$

The stock solution is 5%; written as a fraction it is $\frac{5}{100}$ and inverted it is $\frac{100}{5}$

The number of cubic centimeters to be made up is 1000, then

$$\frac{1}{\cancel{2500}\ 25} \times \frac{\cancel{100}}{5} \times \frac{200}{\cancel{1000}} = X \text{ or } X = \frac{200}{25} = 8$$

The amount of the 5% solution of bichloride of mercury to be used, is therefore, 8 c.c.; which, added to 1000 c.c. of water makes up a 1 to 2500 solution.

Example: How much of a solution of silver nitrate, containing 48 grains to the ounce, must be used to make up one pint of a 1 to 1000 silver nitrate solution.

A solution of silver nitrate, containing 48 grains to the ounce is the same as 48 grains to 480 grains; or $\frac{48}{480} = \frac{1}{10}$ or a ten per cent solution, or $\frac{10}{100}$ or $\frac{1}{10}$.

1 pint = 500 cubic centimeters

The solution to be made up, is a 1 to 1000; written as a fraction it is $\frac{1}{1000}$

The stock solution is a 10% solution, or 1 to 10, written as a fraction it is $\frac{1}{10}$ and inverted, it is $\frac{10}{1}$

then $\frac{1}{\cancel{1000}\ 2} \times \frac{10}{1} \times \cancel{500}$ = the amount of stock solution to use

$$X = \frac{10}{2} = 5$$

The amount to use, is therefore 5 cubic centimeters of the stock silver nitrate solution, which is added to 1 pint or 500 cubic centimeters.

Example: How much of a 1 to 1000 potassium permanganate solution will have to be used in making up five pints of a 1–3000 solution.

The required solution is $\frac{1}{3000}$

The stock solution is $\frac{1}{1000}$, inverted $\frac{1}{1000} = \frac{1000}{1}$

5 pints = 2500 c.c. (since 1 pint = 500 cubic centimeters)

$$\text{then } \frac{1}{\cancel{3000}\ 3} \times \frac{\cancel{1000}}{1} \times 2500 = X$$

$$X = \frac{2500}{3} = 833\tfrac{1}{3} \text{ cubic centimeters}$$

or approximately, 833 cubic centimeters of the 1–1000 potassium permanganate solution is added to 5 pints of water, to make up a solution of 1 to 3000.

METHODS OF PREPARING DOSES OF DRUGS FROM TABLETS OR FROM SOLUTIONS OF VARIOUS STRENGTHS

(1) Methods of Administering Tablets

Hypodermic tablets are usually made in certain definite strengths, and various combinations of drugs. To administer them, they should be dissolved in about 1 c.c. (m. xv) of sterile water, which is then drawn up into the syringe, and administered to the patient.

Occasionally, the nurse may not have a particular tablet of a certain dose with her, and she may be unable to obtain it at short notice. In such cases she should find out what part the required dose is of her stock tablets, and give that fraction of her stock tablet. This is best done by dissolving the stock tablet in about 1 or 2 c.c. of sterile water, and giving the necessary fraction of the amount.

Example: How would you give a patient $\frac{1}{60}$ gr. strychnine sulphate when you have only tablets of $\frac{1}{30}$ gr.

To give $\frac{1}{60}$ gr. from a $\frac{1}{30}$ gr. tablet, we will give as much as $\frac{1}{30}$ is contained into $\frac{1}{60}$ or

$$\frac{1}{60} \div \frac{1}{30} = \frac{1}{60} \times \frac{30}{1} = \frac{30}{60} = \frac{1}{2}$$

We therefore have to give $\frac{1}{2}$ of the $\frac{1}{30}$ gr. tablet. This is best done by dissolving the $\frac{1}{30}$ gr. tablet in 1 c.c. (m. xv) of sterile water, and then giving about 0.5 c.c. (m. viii) of that solution to the patient.

Rule 1. To find therefore, what part of a stock tablet should be used to give a required dose, divide the dose of the stock tablet into the required dose. The result is the amount or fraction of the stock tablet to use.

Example: How would you give $\frac{1}{120}$ gr. of atropine when you only have tablets of $\frac{1}{100}$ gr.

The required dose is $\frac{1}{120}$ gr. The stock dose is $\frac{1}{100}$ gr.

$$\frac{1}{120} \div \frac{1}{100} = \frac{1}{120} \times \frac{100}{1} = \frac{100}{120} = \frac{5}{6}$$

We therefore give $\frac{5}{6}$ of the $\frac{1}{100}$ gr. tablet

Therefore, dissolve the tablet in 2 c.c. or (m. xxx) of sterile water, fill up the hypodermic syringe with the resulting solution and give 1.5 c.c. or (m. xxv) of the contents of the syringe.

In administering hypodermic drugs, the quantity of fluid injected, should never be less than 0.6 (six decigrammes) or 10 minims; as smaller quantities are difficult to handle.

To administer smaller doses of drugs when only a limited number of tablets of a greater strength are in stock.

The nurse may be called upon to give smaller doses of drugs, than those she has with her, and she may be unable to obtain the necessary tablets at short notice.

Example: The doctor orders a patient to have $\frac{1}{300}$ gr. of strychnine every two hours. The nurse only has one tablet of $\frac{1}{30}$ gr. with her. How many doses of $\frac{1}{300}$ of a grain has she with her, and how should she prepare an accurate dose?

She has as many doses as $\frac{1}{300}$ is contained into $\frac{1}{30}$

$$\text{or } \frac{1}{30} \div \frac{1}{300} = \frac{1}{30} \times \frac{300}{1} = \frac{300}{30} = 10$$

To administer the proper amount, she should dissolve the tablet in 10 cubic centimeters of water and give 1.0 c.c. or 15 minims, for each administration, since every cubic centimeter contains $\frac{1}{300}$ gr.

Rule 2. To find the number of smaller doses of drugs that are contained in a limited number of stock tablets of a greater strength, divide the dose to be administered into the total amount, or total fraction, of the stock tablets.

The result is the number of doses the nurse has in stock. Dissolve the stock amount in the resulting number of cubic

centimeters of water. Every cubic centimeter, or every 15 minims will then contain the required dose.

Example: To administer $\frac{1}{400}$ gr. strychnine when the nurse has only two tablets of $\frac{1}{20}$ gr. each in stock.

$$\frac{1}{20} + \frac{1}{20} = \frac{1}{10} \text{ the amount in stock}$$

The required dose is $\frac{1}{400}$ gr.

$$\frac{1}{10} \div \frac{1}{400} = \frac{400}{10} = 40$$

The nurse then has 40 doses of strychnine, each containing $\frac{1}{400}$ gr. Dissolve the two tablets in 40 c.c. of sterile water, and give 1 c.c. (m. xv) for each dose.

TO MEASURE A REQUIRED DOSE OF A DRUG FROM STOCK SOLUTIONS OF VARIOUS STRENGTHS

In hospital practice, the nurse is often called upon to obtain for hypodermic or internal use a fractional dose of a drug, from solutions of various percentages.

Often the correct amount can be obtained by measuring a definite quantity of the stock solution.

For example: To give $\frac{1}{100}$ gr. strychnine from a 1% solution.

Each minim (or drop) contains $\frac{1}{100}$ grain of strychnine.

To administer such a dose, it is only necessary to draw up a quantity of the solution in a minim dropper, drop one drop in a medicine glass, and add about 9 minims (or drops) of water. Draw the entire quantity (10 drops) into a hypodermic syringe, and administer it to the patient.

Example: To give $\frac{1}{25}$ gr. strychnine from a 1% solution.

Each drop of the 1% solution contains $\frac{1}{100}$ gr. of strychnine.

Since each drop contains $\frac{1}{100}$ gr., $\frac{1}{25}$ gr. will be contained in as many drops as $\frac{1}{100}$ is contained into $\frac{1}{25}$ or

$$\frac{1}{25} \div \frac{1}{100} = \frac{1}{25} \times \frac{100}{1} = \frac{100}{25} = 4$$

We therefore give 4 minims (or drops) of the 1% strychnine solution, to administer $\frac{1}{25}$ gr.

Rule 1. If the correct dose can be obtained from the stock solution, divide the fraction of a grain contained in one drop of the stock solution, into the required dose, and take the resulting number of drops of the stock solution.

To the number of drops thus obtained, add enough water to make up at least 10 or 15 minims, draw up the resulting solution into a hypodermic syringe and administer it to the patient.

Example: To give $\frac{1}{25}$ gr. of strychnine from a solution of which m. x = $\frac{1}{30}$ gr.

$$\text{Since m. x} = \frac{1}{30} \text{ gr. each drop or}$$

$$\text{m. i, will contain } \frac{1}{10} \text{ of } \frac{1}{30} \text{ or } \frac{1}{300} \text{ gr.}$$

If each drop contains $\frac{1}{300}$ gr., $\frac{1}{25}$ gr. will be contained in as many drops as $\frac{1}{300}$ is contained in $\frac{1}{25}$ or

$$\frac{1}{25} \div \frac{1}{300} = \frac{1}{25} \times \frac{300}{1} = \frac{300}{25} = 12$$

We therefore would have to give the patient 12 drops of the stock solution (of which m. i = $\frac{1}{30}$ gr.).

Example: To give 4 grs. of caffeine sodium benzoate from a 25% solution.

Each drop of a 25% solution contains $\frac{25}{100}$ gr. of caffeine sodium benzoate or $\frac{1}{4}$ gr.

To give 4 grs. therefore, we would have to give as many drops as $\frac{1}{4}$ is contained into 4.

$$\text{or } 4 \div \frac{1}{4} = 4 \times \frac{4}{1} = 16$$

We would give then, 16 drops of the 25% caffeine sodium benzoate solution—to administer a dose of 4 grains.

The above method is only applicable, however, in cases where the correct amount can be obtained from the original stock solution.

In most cases, the following method is better, especially where the accurate quantity cannot be measured easily.

In such cases, the solution must be diluted, so that the nurse can then measure the required amount accurately.

Example: To give $\frac{1}{300}$ gr. of atropine from a 1% solution.

By taking one part of the solution and two parts of water, a solution is obtained of which each drop contains $\frac{1}{300}$ gr.

Practically, this is obtained by taking one drop of the stock solution, adding two drops of water to this, and taking one drop of the resulting solution, and then adding enough water to fill the hypodermic syringe.

NOTE. The drop referred to, in the foregoing and following examples, refers to the drop obtained from a minim dropper.

The following method will enable the nurse to find out in every case the number of times necessary to dilute the stock solution.

1. The fraction of a grain of a drug contained in each drop of a solution is the proportion of the drug to water in that solution.

For Example: Each drop of a 1% solution contains $\frac{1}{100}$ gr.

Each drop of a 2% solution contains $\frac{2}{100}$ or $\frac{1}{50}$ of a grain

Each drop of a 4% solution contains $\frac{4}{100}$ or $\frac{1}{25}$ of a grain

Rule 2. Reduce the smallest fraction of a grain contained in one drop of the stock solution, and the fraction to be administered, to fractions with the same least common denominator.

To find the proper dilution, take one drop of the stock solution, add as many drops of water, as the difference between the numerator of the fraction contained in one drop of the stock solution, and the numerator of its equivalent fraction.

The number of drops of the resulting solution to use, is indicated by the numerator of the required dose, when reduced to its equivalent fraction.

Example: To give $\frac{1}{200}$ of gr. atropine from a 1% solution.

1. Each drop of the atropine solution contains $\frac{1}{100}$ gr.

2. The required dose is $\frac{1}{200}$ gr.

3. The least common denominator of 100 and 200, is 200

$$\frac{1}{100} = \frac{2}{200}$$

$$\frac{1}{200} = \frac{1}{200}$$

Then take one drop of the atropine solution, and add one drop of water, since 2 – 1 = 1.

(This makes a solution of which each drop contains $\frac{1}{200}$ gr.)

The number of drops of the resulting solution to use, is indicated by the numerator of $\frac{1}{200}$ when reduced to its equivalent fraction, $\frac{1}{200}$, which is 1.

We therefore take one drop of the atropine solution, add one drop of water, and then take one drop of the resulting solution. To this drop, add enough water to fill about 10 minims of the hypodermic syringe and administer this to the patient.

Example: How would you give $\frac{1}{150}$ gr. of atropine from a 1% solution?

1. Each drop of the atropine solution contains $\frac{1}{100}$ gr.
2. The required dose is $\frac{1}{150}$ gr.
3. The least common denominator of 100 and 150 is 300

$$\frac{1}{100} = \frac{3}{300}$$

$$\frac{1}{150} = \frac{2}{300}$$

Take one drop of atropine solution, add to that as many drops of water as the difference between the numerator of the stock fraction $\frac{1}{100}$ (numerator = 1), and its equivalent fraction $\frac{3}{300}$ (numerator = 3) 3 − 1 = 2.

Add therefore, 2 drops of water.

The numerator of the required fraction when reduced to its equivalent fraction, $\frac{1}{150} = \frac{2}{300}$ (numerator = 2), is the number of drops of the resulting fraction to use.

To give $\frac{1}{150}$ gr. atropine from a 1% solution, we take one drop of the stock solution add 2 drops of water, and take 2 drops of the resulting solution, then add about 8 drops of water, and administer the drug. 8 drops of water are added, since hypodermic medicines should never be given in quantities less than 0.6 c.c. (10 minims) in order to overcome leakage from the syringe.

Example: To give $\frac{1}{300}$ gr. atropine sulphate from a $\frac{1}{2}$% solution. Each drop of $\frac{1}{2}$% atropine solution contains

$$\frac{\frac{1}{2}}{100} = \frac{1}{200} \text{ gr.}$$

Least common denominator is 600

$$\frac{1}{200} = \frac{3}{600}$$

$$\frac{1}{300} = \frac{2}{600}$$

Then take one drop of the ½% atropine solution and add two drops of water (3 − 1 = 2) and take two (numerator of $\frac{2}{600}$, which is same as $\frac{1}{300}$) drops of the resulting solution.

Rule 3. To measure doses greater than that contained in one drop of stock solution.

In preparing doses less than that contained in one drop of the stock solution, we find no difficulty with this method. In doses greater than that contained in one drop of the stock preparation, we may find, that when we take one drop of the stock solution, and after adding the required number of drops of water, the total amount made up, may be less than the number of drops of the resulting solution to use.

Example: To give $\frac{1}{60}$ gr. of strychnine, from a 1% solution. Each drop of a 1% solution contains $\frac{1}{100}$ gr. strychnine.

$$\frac{1}{100} = \frac{3}{300}$$

$$\frac{1}{60} = \frac{5}{300}$$

3–1=2 the number of drops of water to add.

We would then have to take one drop of the stock solution, and add to this, two drops of water. We then take five drops of this resulting solution; but, the total number of drops of the resulting solution, is only three, while the number to be used, is five, more than the total amount.

Since the object of taking one drop of the stock solution, and adding two drops of water, is to make up a solution, of which each drop shall contain $\frac{1}{300}$ of a gr. of strychnine, and then, instead of giving $\frac{1}{60}$ gr. of strychnine, we give, what is equal to it, $\frac{5}{300}$ of gr. or 5 drops of the resulting solution.

Instead then, of taking **one drop** of the strychnine stock solution, and adding **two drops** of water, thus making up only three drops of a solution (of which each drop contains $\frac{1}{300}$ gr.), we **multiply** the number of drops of the stock solution to use, and the number of drops of water to add to this, each by 5, or 10, or any number greater than the number of drops to administer. In this way, we make up a larger quantity of the same solution, each drop of which contains $\frac{1}{300}$ gr. In the example given above, if we multiply the number of drops of stock solution to use, and the number of drops of water to add to this, each by 5, we make up 15 drops of a solution, each drop of which contains $\frac{1}{300}$ gr. of strychnine. Five drops of this solution will contain $\frac{1}{60}$ or $\frac{5}{300}$ gr. of strychnine.

Therefore, whenever we find that the total of one drop of the stock solution, and the number of drops of water to be added, is less than the number of drops of this resulting solution to be given, we multiply both the drop of solution, and the number of drops of water to be added to it, by any number that will make the total number of drops to be made up, greater than the amount of drops to be administered.

Example: To give $\frac{1}{120}$ gr. strychnine from a $\frac{1}{2}\%$ solution.

Each drop of the strychnine solution contains $\frac{1}{200}$ gr. strychnine.

Least common denominator of 200 and 120 = 600

$$\frac{1}{200} = \frac{3}{600}$$

$$\frac{1}{120} = \frac{5}{600}$$

Take one drop of $\frac{1}{2}\%$ solution of strychnine, add (3 − 1 = 2) 2 drops of water, and take 5 drops of the resulting solution; but the total amount of the resulting solution is only 3 drops, then we multiply the drop of stock solution, and the number of drops of water to add, each by 3. We would then take 3 drops of the $\frac{1}{2}\%$ solution of

METHOD OF PREPARING AND ADMINISTERING REQUIRED DOSES OF MEDICINES FROM STOCK SOLUTIONS OF VARIOUS STRENGTHS

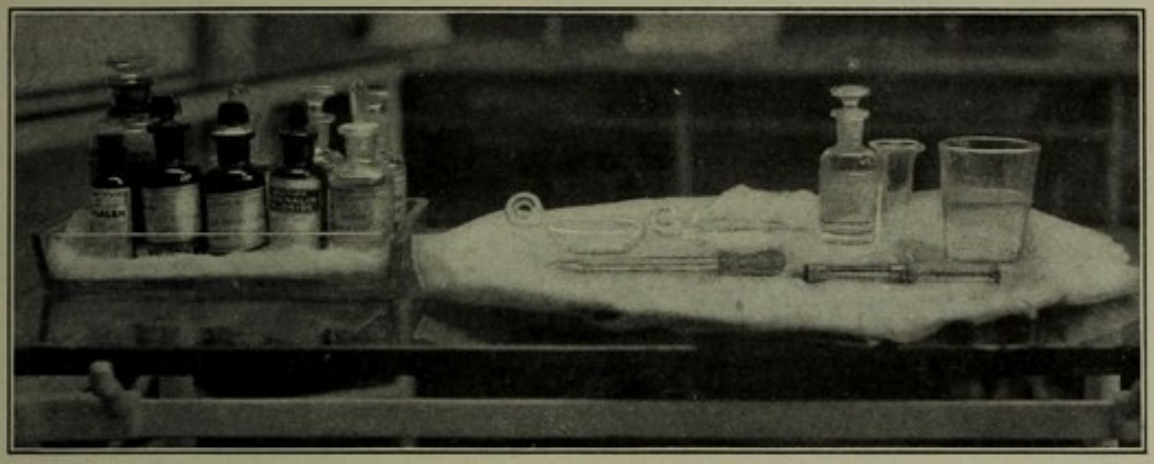

FIG. 1. Apparatus necessary for measuring and administering solutions for hypodermic and internal use.

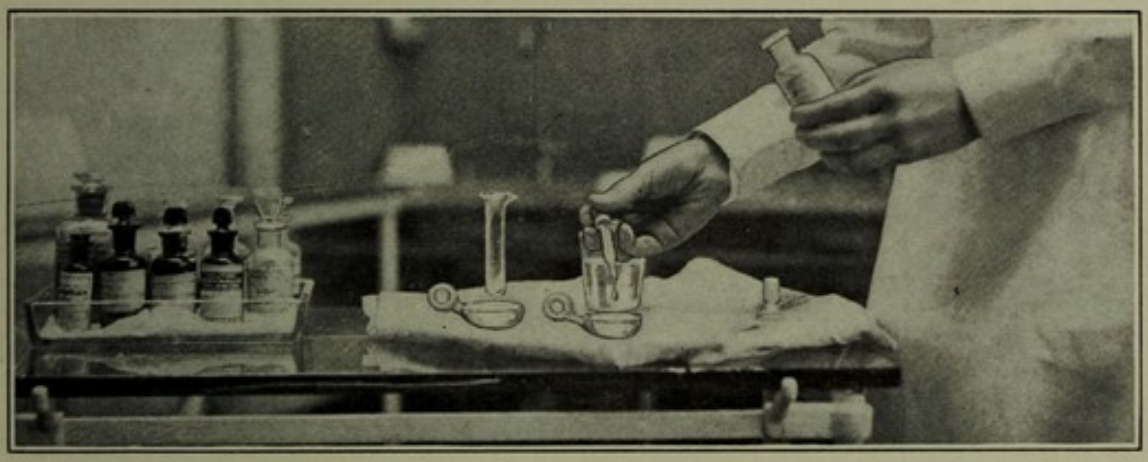

FIG. 2. Measuring the required amount of stock solution.

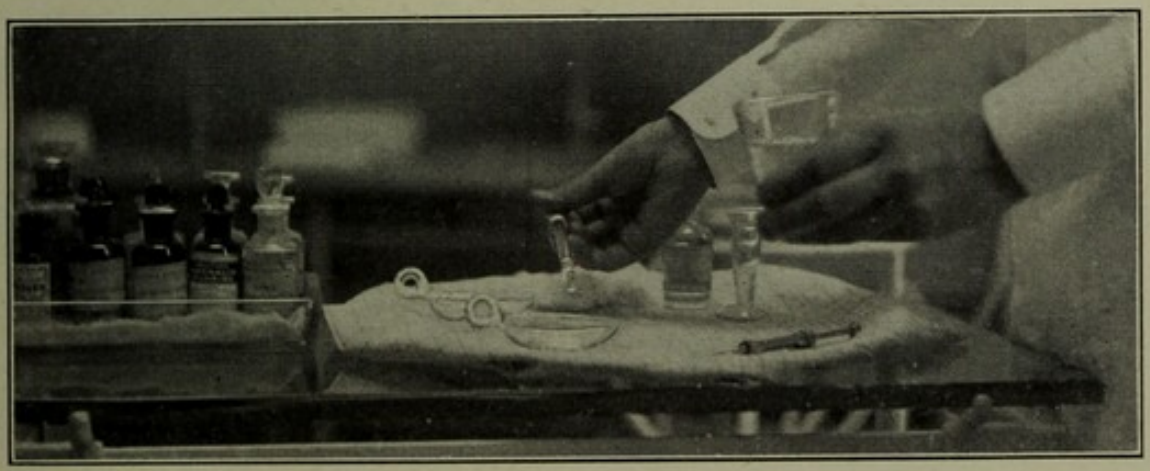

FIG. 3. Adding the necessary amount of water.

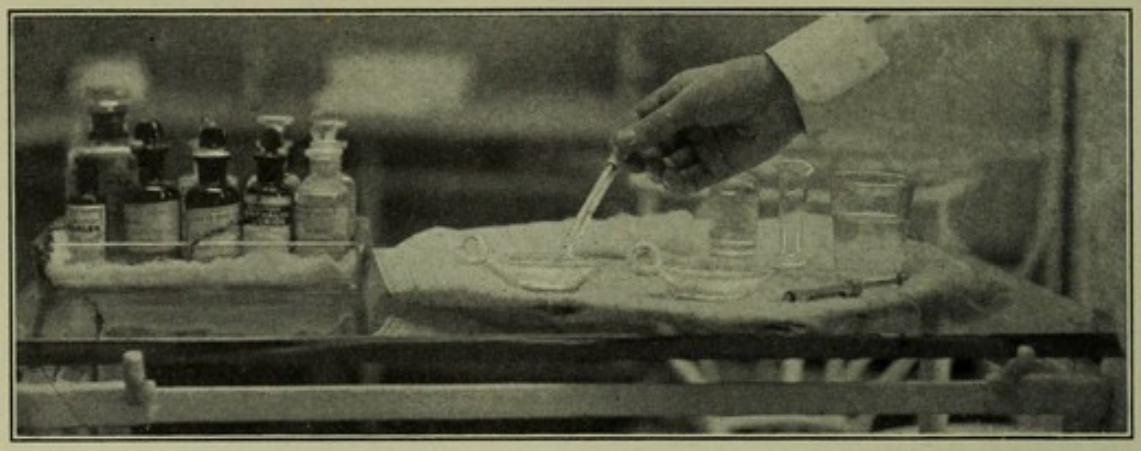

FIG. 4. Measuring the required amount of the resulting solution.

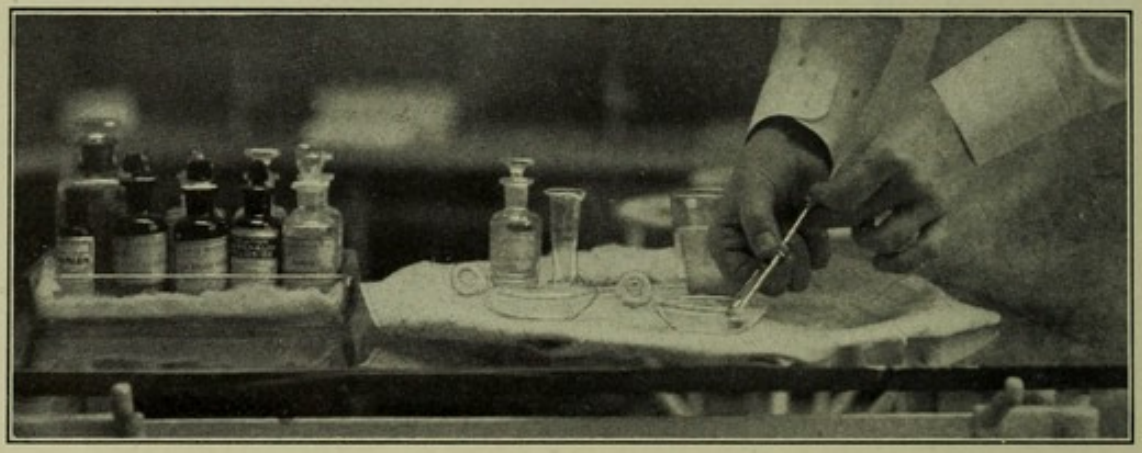

FIG. 5. Drawing up the required amount of the resulting solution into the hypodermic syringe.

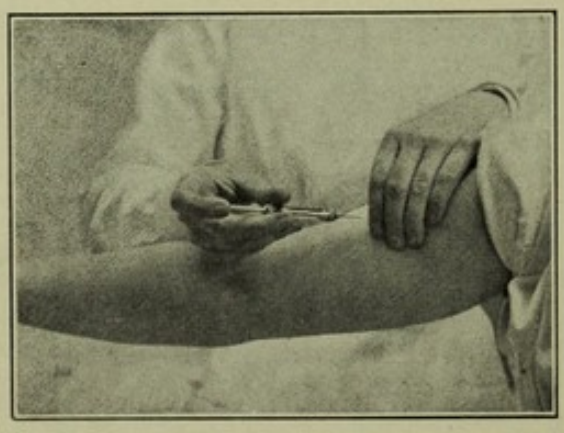

FIG. 6. The correct way to administer hypodermic medication. (Note the direction of the needle.)

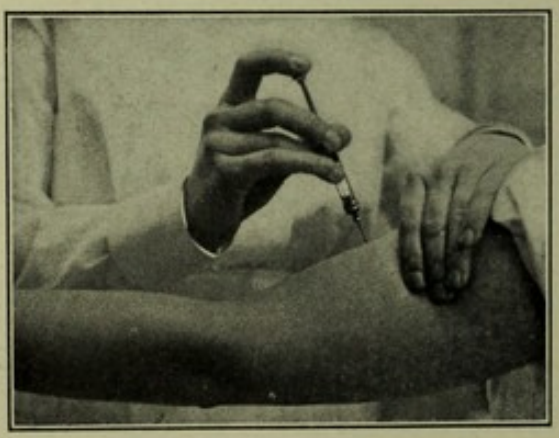

FIG. 7. The wrong way to administer hypodermic medication.

strychnine, and add 6 drops of water to that, and then give the patient 5 drops of the resulting solution.

Example: To give $\frac{1}{75}$ gr. of atropine from a solution of which m. v = $\frac{1}{40}$ gr.

Since m. v = $\frac{1}{40}$ gr., m. i = $\frac{1}{5}$ of $\frac{1}{40}$ = $\frac{1}{200}$ gr.

Each minim of the stock solution contains $\frac{1}{200}$ gr. atropine

The least common denominator of 200 and 75 = 600

$$\frac{1}{200} = \frac{3}{600}$$

$$\frac{1}{75} = \frac{8}{600}$$

Take one drop of the atropine solution (stock) and add (3 − 1 = 2) drops of water, and take 8 drops of the resulting solution; but since the total amount of the resulting solution, is less than 8 drops, we multiply the number of drops of the stock solution, and the number of drops of water to add to this, each by 4 (to make up a sufficiently large quantity). We then take 4 drops of the atropine solution, and add 8 drops of water, and then take 8 drops of the resulting solution.

We therefore take 8 drops of the resulting solution, and draw it up into the hypodermic syringe and administer it to the patient.

TABLE OF USUAL STRENGTHS OF COMMONLY USED SOLUTIONS FOR EXTERNAL USE

Name of Solution	Percentage of Solution	Number of Grains to Quart
Alcohol	50 to 95%	16 — 30 oz.
Aluminium Acetate (Burrow's Solution) Stock sol.	2 to 7%	5 dr'ms — 2 oz.
Aluminium Acetate (Burrow's Solution) for local use	½ to 2%	1 dr'm — 5 dr'ms
Argyrol	5 to 25%	1½ oz. — 8 oz.
Boric Acid	3%	1 oz.
Calcium Hydroxide Solution (lime water)	1/5%	½ dr'm
Carbolic Acid	2 to 5%	5 dr'ms — 1½ oz.
Collargol	4%	1¼ dr'ms
Cocaine Hydrochloride	½ to 4%	1¼ dr'ms
Chlorine water	0.4%	
Corrosive Sublimate (Bichloride of Mercury) Stock Alcoholic Solution	2%	5 dr'ms
Corrosive Sublimate (Bichloride of Mercury) for use	0.1 to 0.01% (1–1000 to 1–10000)	15 grs. — 2 grs.
Creolin	½ to 2%	1¼ dr'm — 5 dr'ms
Cresol	5%	1½ oz.
Eserine Sulphate	½ to 1%	1¼ dr'ms — 2½ dr'ms
Eserine Salicylate	½ to 1%	1¼ dr'ms — 2½ dr'ms
Formalin (Stock) Solution	40% of formaldehyde gas	
Formalin (for use)	½ to 0.05%	1¼ dr'ms — 10 grs.
Holocain	1 to 2%	2½ dr'ms 5 dr'ms
Hydrogen Peroxide	3%	1 oz.
Icthyol	5 to 50%	1½ oz. — 16 oz.
Iron Subsulphate (Monsell's Solution)	13%	4 oz.
Iron Tersulphate	10%	3 oz.

TABLE OF USUAL STRENGTHS OF COMMONLY USED SOLUTIONS FOR EXTERNAL USE

Name of Solution	Percentage of Solution	Number of Grains to Quart
Iodoform	5 to 10%	1½ oz. — 3 oz.
Labbaracque's Solution (Solution of Chlorinated Soda)	2½%	6 dr'ms
Lugol's Iodine Solution	5%	1½ oz.
Lysol	½ to 3%	1 dr'm — 1 oz.
Naphthol	1 to 50%	2½ dr'ms 16 oz.
Pilocarpine Hydrochloride	½ to 2%	1¼ dr'ms — 5 dr'ms
Potassium Chlorate	2 to 5%	5 dr'ms 1½ oz.
Potassium Permanganate	1 to 5%	2½ dr'ms — 1½ oz.
Protargol	½ to 10%	1¼ dr'ms — 3 oz.
Resorcin	25%	8 oz.
Sodium Chloride (salt) (Normal Solution)	0.9%	2 dr'ms
Sodium Chloride (salt) (Physiological Solution)	0.6%	1½ dr'ms
Silver Nitrate	1 to 20%	2½ dr'ms — 6 oz.
Zinc Chloride	1 to 2%	2½ dr'ms — 5 oz.
Zinc Sulphate	¼%	35 grs.

TABLE OF USUAL STRENGTHS OF COMMONLY USED SOLUTIONS FOR INTERNAL USE

Name of Solution	Percentage of Solution	Number of grs. to Ounce
Ammonium Bromide	25%	2 dr'ms
Ammonium Iodide	50%	4 dr'ms
Aromatic Spirits of Ammonia	4%	20 grs.
Adrenalin Chloride	0.1% (1–1000)	½ gr.
Arsenious Acid Solution	1%	5 grs.
Caffeine Sodium Benzoate	25%	2 dr'ms
Camphor Oil	20%	1½ dr'ms
Camphor Spirits	10%	50 grs.
Camphor Water	0.8%	1½ grs.
Dilute Acetic Acid	6%	30 m.
Dilute Hydrochloric Acid	10%	50 m.
Dilute Hydrocyanic Acid	2%	10 m.
Dilute Nitric Acid	10%	50 m.
Dilute Nitrohydrochloric Acid	20%	1⅔ dr'ms
Dilute Sulphuric Acid	10%	50 m.
Diuretin Solution (Theobromine Sodium Salicylate)	25%	2 dr'ms
Fowler's Solution of Arsenic (Liquor Potassii Arsenitis)	1%	5 grs.
Homatropine Hydrobromide	2%	10 grs.
Mercury Salicylate	0.02% (1–5000)	1/10 gr.
Morphine Sulphate (Magendies Solution)	3%	15 grs.
Nitroglycerin solution	1%	5 grs.
Paregoric (Tinct. Opii. Camphorata)	0.4%	2 grs.
Potassium Iodide Solution (Saturated)	100%	480 grs.
Potassium Iodide Solution	50%	240 grs.
Sodium Bromide	50%	4 dr'ms
Sodium Iodide Solution	50%	240 grs.
Spirits of Chloroform	10%	50 m.
Spirits of Ether	30%	2½ dr'ms
Spirits of Ether (Compound)	30%	2½ dr'ms
Strontium Bromide	50%	4 dr'ms

CHAPTER V

CLASSIFICATION

All drugs affect the body, or an organ of the body, by either **increasing** or **lessening** its activity.

A drug which increases the activity of the body, or any of its organs, is called a **stimulant:** the act of increasing the activity is called **stimulation.**

A substance which lessens the activity of the body, or any of its organs, is called a **depressant:** the act of lessening the activity is called **depression.**

When the activity of an organ is increased to such an extent that it is overacting, it is said to be **irritated** or **overstimulated.** A substance which produces such effects is called an **irritant.**

The effects produced by irritation may be those of lessened activity or **depression,** since, by overacting, an organ may become exhausted. *For example*—the poisonous effects of some drugs which ordinarily increase the activity of the body, may be those of lessened activity.

A poisonous substance usually harms the patient by either causing a very great overactivity of the body (irritation), or by greatly lessening its activity (depression).

Most drugs **increase** or **lessen** the activity only of **one** or a **number** of organs of the body.

We can classify all drugs, therefore, according to whether they **stimulate,** or **depress** the activity of body, or any of its organs, and according to the organs they principally affect.

CLASSIFICATION OF DRUGS

(Only the most important drugs are here given)

STIMULANTS	DEPRESSANTS
Increasing activity	Lessening activity

DRUGS ACTING ON GASTERO-INTESTINAL TRACT

STOMACH

Gentian
Calumba
Serpentaria
Berberis
Capsicum
Cardamum
Cinchona
Ginger
Peppermint
Spearmint
Wild Cherry
Ipecac
Apomorphine

INTESTINAL TRACT

Phenolpthalein
Cascara
Castor Oil
Senna
Rhubarb
Aloes
Licorice
Euonymus
Scammony
Elaterium
Croton Oil
Colocynth
Gamboge
Jalap
Podophyllum

DRUGS ACTING PRINCIPALLY AFTER ABSORPTION

DRUGS WHICH AFFECT THE BLOOD AND BLOOD FORMING ORGANS

STIMULANTS	DEPRESSANTS
Iron	
Arsenic	
Calcium Lactate	

DRUGS WHICH AFFECT THE HEART

Caffeine	Aconite
Atropine (Belladonna Group)	Veratrum Viride
Digitalis Group	(Eserine)
(Strophantus)	(Pilocarpine)
(Convallaria)	
(Squills)	
Strychnine	
Camphor	
Ammonia	

DRUGS WHICH AFFECT THE BLOOD VESSELS

Adrenalin	Amyl Nitrite
	Nitroglycerin
	(Nitrite Group)

DRUGS WHICH AFFECT THE RESPIRATION

(Atropine)	Hydrocyanic Acid
(Caffeine)	(Opium and Morphine)
(Strychnine)	(Chloroform)
(Camphor)	(Choral)
	(Aconite)

DRUGS WHICH AFFECT THE NERVOUS SYSTEM

THE BRAIN

Alcohol	Bromides
Coca	Hyoscine
(Atropine)	
(Caffeine)	

STIMULANTS **DEPRESSANTS**

TO PRODUCE ANAESTHESIA

Chloroform
Ether
Ethyl Chloride
Nitrous Oxide

TO RELIEVE PAIN
(ANODYNES)

Opium and Morphine
Cannabis Indica
Gelsemium

TO RELIEVE PAIN (ALLAY NERVOUSNESS), AND REDUCE TEMPERATURE
ANTIPYRETIC GROUP

Acetanilid
Antipyrine
Phenacetine
Pyramidon
and similar unofficial products

TO PRODUCE SLEEP
HYPNOTICS

Chloral Group
Trional
Tetronal
Veronal
Sulphonal
Chloretone
Hypnal
Paraldehyde

SPINAL CORD

Strychnine

DRUGS ACTING ON THE SECRETORY GLANDS

Pilocarpine **(Atropine)**
(Eserine) **Camphor**
(Ipecac)

DRUGS ACTING ON THE INVOLUNTARY MUSCLES

STIMULANTS	DEPRESSANTS
Eserine	Atropine

DRUGS ACTING ON THE GENITAL ORGANS

Ergot
Hydrastis (Hydrastinine)
Rue
Tansy
Savine
Pituitary Extracts
(Quinine)
Viburnum

DRUGS ACTING ON THE KIDNEYS

Diuretin
Agurin
Potassium Acetate
Potassium Citrate
Potassium Bitatarate
Potassium Nitrate
Sodium Acetate
Sodium Nitrate
Caffeine
Theobromine
(Digitalis Group)
Mercury (Calomel and Blue Pill)

SPECIFICS

DRUGS WHICH CURE PARTICULAR DISEASES (USUALLY BY DESTROYING THE CAUSE)

FOR MALARIA

(Arsenic)
Quinine

FOR SYPHILIS

Mercury
Salvarsan
Iodides

FOR RHEUMATISM

Sodium Salicylate
Salicylic Acid
Salicin
Salol
Aspirin
And Their Derivatives

FOR GOUT

Colchicum

ANTHELMINTICS

DRUGS WHICH DESTROY WORMS

FOR TAPE WORM

Aspidium
Cusso
Pepo
Kamala
Granatum
Pelletierine

FOR ROUND WORM

Santonin
Spigelia
Senna

FOR THREAD WORM

Quassia
(Alum)

FOR HOOK WORM

Thymol
Naphthol
(Calomel)

DRUGS ACTING CHEMICALLY

ACIDS

MINERAL ACIDS

Hydrochloric Acid
Sulphuric Acid
Nitric Acid

VEGETABLE ACIDS

Acetic Acid
Citric Acid
Tartaric Acid

ALKALIES, ALKALINE EARTHS, AND THEIR SALTS

Sodium
Potassium
Ammonium } **Salts**
Calcium
Magnesium

ASTRINGENTS

DRUGS WHICH CONTRACT TISSUES AND CHECK SECRETIONS OF MUCOUS MEMBRANES

METALLIC

Lead
Copper
Zinc
Aluminium } **Salts**
Silver
Bismuth

VEGETABLE

Tannic Acid
Gallic Acid
Tannigen
Tannalbin and numerous other similar compounds

ANTISEPTICS

DRUGS WHICH CHECK THE GROWTH OF BACTERIA

Carbolic Acid
Creolin
Lysol
Sulphur Dioxide
Calcium Chloride
Bichloride of Mercury
Potassium Permanganate
Hydrogen Peroxide
Boric Acid
Formalin
Iodoform
Eucalyptus
Icthyol
Urotropin
Salol
Naphthol
Thymol
Copaiba
Cubebs
And numerous other similar compounds

DRUGS WHICH ARE USED PRINCIPALLY TO PRODUCE LOCAL EFFECTS ON THE SKIN

RUBEFACIENTS

Drugs which cause redness of the skin

Mustard
Turpentine
Arnica
And many other similar substances

VESICANTS

Drugs which produce blisters

Cantharides
(Mustard)

PUSTULANTS

Drugs which produce small blisters filled with pus

Croton Oil
Tartar Emetic

CAUSTICS

Drugs which are used to destroy tissues

Mineral Acids
Glacial Acetic Acid
Caustic Potash
Caustic Soda
And strong solutions of the metallic astringents

DEMULCENTS AND EMOLLIENTS

Drugs which soften and protect the skin or mucous membranes

Vaseline
Cocoa Butter
Olive Oil
Lanoline
Glycerin
Starch
Flaxseed
Acacia
And other mucilaginous substances

SERUMS, ANTITOXINS, AND VACCINES

Antistreptococcus Serum
Antipneumococcus Serum
Diphtheria Antitoxin
Tetanus Antitoxin
Tuberculin
Staphylococcus Vaccine
Streptococcus Vaccine
Smallpox Vaccine
Bulgaric Bacilli Preparations
And many other similar preparations

ORGANIC SUBSTANCES

DRUGS OBTAINED FROM VARIOUS ORGANS OF ANIMALS

Thyroid Extracts
Pituitary Extracts
Ovarian Extracts
Adrenalin and many other similar substances

Special names are given to drugs causing particular effects. The following is a list of the most important names given to various drugs:

Absorbents are substances which increase the absorption of diseased tissue.

Alteratives are drugs, whose mode of action is unknown, but which improve the nutrition of the tissues, and help to absorb diseased tissues, thereby restoring them to their normal condition.

Anaesthetics are drugs which produce insensibility to pain.

A Local Anaesthetic is one which produces insensibility to pain at the point of application.

A General Anaesthetic is one which produces insensibility to pain all over the body. These drugs also produce unconsciousness.

Analeptics are substances which bring about health and strength.

Analgesics are drugs which relieve pain.

Anodynes are drugs which relieve pain.

Antacids are drugs which neutralize acids. They are usually given to neutralize the acid in the stomach.

Anthelimintics are drugs which destroy or expel worms.

Antiarthritics are drugs which relieve gout.

Antilithics are drugs which prevent the formation of stones.

Antiperiodics are drugs which relieve regular attacks of chills and fever, as in malaria.

Antipyretics are drugs which reduce fever.

Antiseptics are substances which check the growth of germs.

Antisialogogues are drugs which check the flow of saliva.

Antispasmodics are drugs which lessen contractions of muscles, and also lessen convulsions. The term is also applied to drugs which lessen nervousness, because of the tremors of the muscles which often occur in these conditions.

Antizymotics are drugs which check the action of germs.

Aperients are substances which produce mild movements of the bowels.

Aromatics are spicy substances which increase the secretion of the stomach and intestines.

Astringents are drugs which contract or harden tissues.

Bitters are drugs which increase the appetite because of their bitter taste. They also increase the flow of gastric juice.

Cardiac Stimulants are drugs which increase the activity of the heart, so that it beats stronger and faster.

Cardiac Depressants are drugs which lessen the heart action so that the heart beats slower and weaker.

Carminatives are drugs which produce a feeling of comfort in the stomach and relieve the formation of gas in the stomach and the intestines. They also increase the appetite.

Cathartics are drugs which cause movements of the bowels.

Caustics are substances which burn or destroy the tissues.

Cholagogues are drugs which cause movements of the bowels, the stools being colored with bile. They are said to increase the flow of bile.

Cerebral Stimulants are drugs which increase brain activity making the patient more active, brighter and more talkative (in large doses such drugs may produce delirium, hallucinations, convulsions, etc.).

Cerebral Depressants are drugs which lessen brain activity. The patient is dull and less active. In large doses they may produce sleep.

Convulsants are drugs which produce convulsions.

Correctives are substances used to make unpleasant drugs more pleasant to the taste.

Counter Irritants are drugs which relieve pain or affect an organ or part of the body, by being applied to an area of the skin which has nerves communicating with that organ or part of the body.

Delirifacients are drugs which increase the activity of the brain, and often cause delirium.

Demulcents are bland slippery liquids, used to coat, protect and lubricate a mucous membrane or surface of the body.

Deodorants are remedies which destroy unpleasant odors.

Depilatories are substances used to remove hair.

Depresso-motors are drugs which lessen the impulses for motion sent from the brain or spinal cord.

Depurants are drugs which increase the excretions of the body and thereby purify it.

Detergents are substances which clean wounds.

Diaphoretics are drugs which cause perspiration.

Digestives or **Digestants** are substances which aid the digestion of food.

Disinfectants are drugs which check the growth of bacteria.

Diuretics are drugs which increase the flow of urine, both in amount and frequency.

Ecbolics are drugs which contract the uterus and empty its contents; thereby producing abortion, or assisting labor.

Emetics are drugs which produce vomiting.

Emmenagogues are drugs which bring about menstruation.

Emollients are drugs which soften and protect the surface of the body.

Errhines are drugs which increase the nasal secretions, and produce sneezing.

Epispastics or **Escharotics** are drugs which produce blisters and destroy the skin of the area over which they are applied.

Excito-motors are drugs which increase the impulses for motion, that are sent out from the brain or spinal cord.

Expectorants are drugs which increase coughing and bronchial secretions.

Evacuants are drugs which empty the bowels

Febrifuges are drugs which reduce fever.

Galactogogues are drugs which increase the secretion of milk.

Haemostatics are substances which check bleeding.

Hydragogues are drugs which produce frequent watery movements of the bowels.

Hypnotics are drugs which produce sleep.

Laxatives are drugs which produce few mild movements of the bowels.

Myotics are drugs which narrow (contract) the pupil of the eye.

Mydriatics are drugs which (widen) dilate the pupil of the eye.

Oxytocics are drugs which increase contractions of the uterus.

Prophylactics are medicines which prevent the development of a disease.

Purgatives are drugs which produce moderately active and frequent movements of the bowels.

Refrigerants are substances which relieve thirst and cool the patient, in fever.

Respiratory Stimulants are drugs which increase the depth and frequency of breathing.

Respiratory Depressants are drugs which lessen the frequency and depth of breathing.

Revulsants are drugs which draw blood from the deeper parts to the surface.

Rubefacients are drugs which redden the skin by widening (dilating) the capillaries.

Saline Purgatives are mineral salts which produce movements of the bowels.

Somnifacients or **Soporifics** are drugs which produce sleep.

Sedatives are drugs which lessen the activity of an organ or part of the body.

Sialogogues are substances which increase the flow of saliva.

Specifics are drugs which cure particular diseases; usually by destroying or combining with, the causative agent.

Stomachics are drugs which increase the activity of the stomach and intestines. They increase the appetite and aid digestion.

Styptics are substances which stop bleeding.

Sudorifics are drugs which produce sweating.

Taenicides are drugs which destroy tape worms.

Tonics are drugs which brace up the patient. They improve the health and vigor of every part of the body. They make the patient feel stronger, healthier, more energetic, and increase the appetite.

Vermicides are drugs which destroy worms.

Vermifuges are drugs which expel worms.

Vesicatories and **Vesicants** are drugs which produce blisters.

ABSORPTION, MODE OF ACTION AND CUMULATIVE ACTION

Drugs which act on different organs of the body, enter the blood stream by being directly injected into it (intravenous administration), or by being absorbed from the tissues into which they are injected (hypodermic administration), or by passing through the lining membrane of the stomach or intestines and entering the blood in this manner (internal administration).

By the circulation of the blood, a drug is carried to the different organs of the body and there it produces its effects.

The effects on the body or on any of its organs are produced:

1. By combining chemically with some of the cells of the various organs, and thereby modifying their activity. Drugs like morphine, or strychnine, act in this way.

2. By dissolving some of the substances of the cells, and changing their activity in this manner. Ether and chloroform act in this way.

EXCRETION

After the effects are produced, the body gets rid of the drug through the various excretory organs such as the skin, the lungs, the kidneys and the bowels.

A drug may be excreted either in its original form, or as some other modified substances.

CUMULATIVE ACTION

Some drugs are excreted much slower than they are absorbed. If such a drug is administered for any length of time, a part of each dose always remains in the body. The effects produced by the amount of drug which accumulates in the body, are called **cumulative effects.** A drug which produces such effects is said to have a **cumulative action.**

As a result of this action, a patient may often get poisonous symptoms when some drugs are given continuously. For, while the patient may be getting an average dose of the drug at every administration, a portion of the previous dose always remains in the body, and the effects produced, are not due entirely to the dose administered, but to it, and the part remaining in the body from the previous dose. They are therefore greater than is to be expected, from one dose.

Drugs which cause cumulative effects are best given for a definite period of time, after which they should be stopped for a while, to allow all of the drug remaining in the body to be excreted, and then they may be given again.

For example, in administering digitalis, which has a cumulative action, it is better to give it for a definite length of time, and then stop the drug for a while, to allow the body to get rid of most of it; thereby avoiding poisonous effects from its cumulative action.

PART I—GASTRO-INTESTINAL STIMULANTS

Drugs which Increase the Activity of the Gastro-Intestinal Tract

CHAPTER VI

GASTRIC STIMULANTS

The stomach changes certain kinds of food (proteids), such as eggs, meat, etc. to simpler, more fluid substances, so that they can be more readily absorbed through the lining membrane of the stomach and intestines, and that they may be more easily acted upon by the digestive juices of the intestinal tract. This process is called digestion.

The digestion of the food is brought about by means of the gastric juice which is secreted by the lining membrane of the stomach. This juice contains two ferments; pepsin and rennin, which together with hydrochloric acid, which is also secreted in the stomach, changes the complex food substances into simpler, more fluid ones.

While these changes are going on, the contractions of the involuntary muscles (peristalsis) of the stomach wall, move the food onward into the intestines, so that the stomach is completely emptied in about two hours.

The functions of the stomach then, are:

1. **Secretory,** to secrete gastric juice and digest the food.
2. **Motor,** to move the digested food onward, into the intestines for further digestion.

A drug may increase only one or both of these functions of the stomach.

BITTERS

Bitters are vegetable drugs which increase the activity of the secretory function of the stomach, but produce no effects after absorption.

There are two kinds of bitters.

1. **Simple bitters:** These are vegetable substances which increase the activity of the stomach, and increase the appetite.

2. **Aromatic bitters** are vegetable substances having a pleasant odor, because of oils that evaporate easily (volatile oils), which these drugs contain. They also increase the activity of the stomach.

There are other drugs, which cause important effects after absorption, but may also act as bitters in the stomach, for example, nux vomica and quinine.

Many substances used as condiments in food, produce the same effect.

Action

Simple bitters have no local action on the skin.

When taken internally, they increase the appetite, and the secretion of gastric juice.

The patient therefore eats more, and digests his food better.

If they are taken for a long period of time, he gains in weight, feels better, and is generally more robust, healthier and stronger.

Poisonous Effects

Occasionally, some of the bitters, such as quassia and berberis, if given in large quantities, may cause **diarrhoea, frequent urination, nausea, vomiting, restlessness,** and a **rapid weak pulse.** These symptoms are due to the alkaloids **quassin** and **berberine** which they contain.

Administration

Bitters should always be given before meals in fluid form.

SIMPLE BITTERS AND THEIR PREPARATIONS

GENTIAN: The root of the **Gentiana lutea,** or the yellow gentian of the Alps. Dose 1.0 gm. (mxv)

Extract of Gentian (Extractum Gentianae)	0.1– 0.6 gm.	grs. ii–x

Fluidextract of Gentian (Fluidextractum Gentianae)	0.6– 2.0 c.c.	m. x–xxx
Compound Tincture of Gentian (Tinctura Gentianae Composita)	2.0–16.0 c.c.	ʒ½–iv

Gentian is often used as a mild laxative.

CALUMBA: The root of **Jateorrhiza palmata,** a climbing vine which grows in Mozambique.

Fluidextract of Calumba (Fluidextractum Calumbae)	1.0– 2.0 c.c.	m. xv–xxx
Tincture of Calumba (Tinctura Calumbae)	4.0–15.0 c.c.	ʒi–iv

Calumba is often used in the treatment of thread worms.

CHIRATA: The herb and root of **Swertia chirata,** a plant growing in the northern part of India.

Fluidextract of Chirata (Fluidextractum Chiratae)	0.3–1.0 c.c.	m. v.–xv

BERBERIS: Barberry, a drug obtained from the root and berries of **Berberis vulgaris,** which grows in Europe. It contains an active principle, **berberine,** an alkaloid, and some tannin, which makes it slightly contract mucous membranes.

Fluidextract of Berberis (Fluidextractum Berberidis)	2.0 c.c.	m. xxx

QUASSIA: A drug obtained from the wood of **Picraena excelsa,** a large tree which grows in Jamaica. It contains an active principle **quassin.**

Extract of Quassia (Extractum Quassiae)	0.06 –0.2 gm.	grs. i–iii
Fluidextract of Quassia (Fluidextractum Quassiae)	0.3 –2.0 c.c.	m. v–xxx
Tincture of Quassia (Tinctura Quassiae)	1.0 –4.0 c.c.	m. xv–ʒi
Quassin (not official)	0.015–0.03 gm.	grs. ¼–½

A 10% infusion of quassia is given as an enema for round worms in children.

CONDURANGO: The bark of the condurango tree.

PAREIRA: The root of the **Chondodendron tomentosum,** a climbing plant of South America. These are other less important simple bitters.

NUX VOMICA, CINCHONA, and their alkaloids, **strychnine** and **quinine** are also used as simple bitters, but their general effects are more important; under which they will be considered.

CETRARIN 0.06–0.2 gm. grs. i–iii

This is a bitter principle obtained from Iceland moss. It is said to increase peristalsis, and the secretion of saliva, bile and pancreatic juice.

OREXIN: This is an artificial chemical substance used as a bitter. It must not be given on an empty stomach, as it is somewhat injurious to the stomach.

AROMATIC BITTERS

The aromatic bitters increase the secretion of the lining membrane of the stomach more than the simple bitters do, on account of the volatile oils which they contain. Their effect is also more lasting, and they contract the mucous membranes, because of small quantities of tannic acid which many of them contain.

They should always be given before meals, best in fluid form.

Aromatic Bitters and Their Preparations

SERPENTARIA: The root of the **Virginia snake root,** a small herb, which grows in the United States. This is often combined with other bitters.

Fluidextract of Serpentaria (Fluidextractum Serpentariae)	1.0–2.0 c.c.	m. xv–xxx
Tincture of Serpentaria (Tinctura Serpentariae)	2.0–8.0 c.c.	ʒ½–ii

PRUNUS VIRGINIANA: A drug obtained from the bark of the wild cherry tree.

Its active principles are **amygdalin,** a glucoside, and an albuminous principle **emulsin.** Both these two substances if rubbed together form prussic acid (hydrocyanic acid).

Prunus Virginiana is often given to increase expectoration and lessen coughing, together with other cough medicines.

Fluidextract of Prunus Virginiana (Fluidextractum Pruni Virginianae)	2.0– 4.0 c.c.	ʒss–i
Infusion of Prunus Virginiana (Infusum Pruni Virginianae) 4% strength	15.0–60.0 c.c.	ʒss–ii
Syrup of Prunus Virginiana (Syrupus Pruni Virginianae) 15% strength	4.0–15.0 c.c.	ʒi–iv

HUMULUS: Hops, and **lupulin,** a powder separated from hops.

Hops are often used in the form of poultices, to relieve pain and produce redness of the skin. The hops are placed in a bag and wrung out in hot water and the bag is then used as a local application, or it may be used dry.

Lupulin (powder) (Lupulinum)	0.3–1.2 gm.	grs. v–xx
Fluidextract of Lupulin (Fluidextractum Lupulini)	2.0–8. c.c.	ʒ ½–ii
Oleoresin of Lupulin (Oleoresinae Lupulini)	0.1–0.3 c.c.	m. ii–v

These preparations are often used in neurasthenia, to lessen nervousness.

ANTHEMIS, CHAMOMILE: The dried flowers of **Anthemis nobilis**, a European plant.

MATRICARIA, German chamomile: The flowers of **Matricaria, chamomilla**, German plant.

EUPATORIUM: The leaves and flowering tops of **boneset,** or **thoroughwort.**

EUCALYPTUS: The leaves of the **blue gum tree** of Australia.

CARMINATIVES

The following drugs are used principally to check the formation, and aid in the expulsion of gas from the stomach and intestines. A drug which has such an action is called a **carminative.** These drugs contain volatile oils, and most of them act also as aromatic bitters.

They are also used to check the griping pains, often caused by cathartics, and because of the pleasant odorous oils which many of them contain, they are used to disguise the taste of unpleasant tasting drugs. Some of them are used as condiments with food.

Action

Local Action: Applied to the skin, they act as antiseptics; and in strong solutions, they cause redness, pain and swelling, often blisters.

On mucous membranes, they cause redness and swelling, pain and smarting, with excessive secretions of mucus.

Internal Action

In the mouth, they produce a hot burning taste, and in large doses they cause redness of the lining membrane of the mouth, and an increased flow of saliva, which aids in the digestion of the food. At the same time they have a very pleasant aroma, and their antiseptic action is again manifested.

In the stomach, they cause a feeling of warmth, and a sense of comfort, and they relieve the feeling of distention after meals.

By their antiseptic action, they lessen the formation, and by causing redness and swelling of the lining membrane of the stomach (irritating), they cause the muscle wall of the stomach to contract, and thus aid in the expulsion of gas (carminative action).

Many of these drugs increase the appetite, and probably by their pleasant aroma, as well as by directly activating

the lining membrane of the stomach and intestines, they increase the secretion of the digestive juices, and aid in the digestion of food.

In the intestines, by their antiseptic action, they lessen the formation of gas, and by causing redness and swelling (irritation), of the lining membrane, they bring about contractions of the muscle wall of the stomach and intestines, and help to expel gas.

Action after Absorption

Occasionally, some of these drugs may cause effects after absorption (see preparations below).

Excretion

These aromatic vegetable drugs are mostly excreted by the expired air and the urine, part of the drug being used up in the body, however.

In their passage through the lungs, they increase the flow of bronchial secretion, thereby increasing expectoration, and in their passage through the kidneys, they may increase the flow of urine (diuretic action).

Some of these drugs are given to produce these effects.

CARMINATIVES (VOLATILE OILS) AND THEIR PREPARATIONS

CAPSICUM, Cayenne Pepper: The extremely pungent fruit of the **Capsicum fastigiatum, or African pepper.**

Tincture of Capsicum (Tinctura Capsici)	2.0 –4.0 c.c.	m. xxx–℥i
Fluidextract of Capsicum (Fluidextractum Capsici)	0.03–0.06 c.c.	m. ½ –i
Oleoresin of Capsicum (Oleoresinae Capsici)	0.01–0.05 c.c.	m. ¼ –i
Capsicum Plaster (Emplastrum Capsici)	For local use	

Capsicum causes marked redness and blistering of the

skin, often destruction of the area of skin over which it is applied.

Internal Action

In large doses it often causes violent pain in the abdomen, with vomiting, followed by profuse diarrhoea and very painful urination.

Uses

Capsicum is used to increase the secretion of the stomach, particularly in drunkards, whose lining membrane of the stomach is so affected that it secretes very little gastric juice.

It is also used in the form of a plaster to produce blisters, in order to draw fluid from deeper tissues into the skin.

ZINGIBER, Ginger: The dried roots of the **Zingiber officinale,** which grows in the East and West Indies. Green ginger is the fresh, and black ginger, the dried roots. The fresher it is, the more active is the ginger.

Fluidextract of Ginger (Fluidextractum Zingiberis)	0.3–1.0 c.c.	m. v–xv
Tincture of Ginger (Tinctura Zingiberis)	2.0–4.0 c.c.	ʒ ss–i
Oleoresin of Ginger (Oleoresinae Zingiberis)	0.06–0.2 c.c.	m. i–ii
Syrup of Ginger (Syrupus Zingiberis)	4.0–8.0 c.c.	ʒi–ii

CARDAMOMUM, Cardamom, is a drug obtained from the fruit of the **Elettaria repens,** which grows in the East Indies.

Tincture of Cardamomum (Tinctura Cardamomi) 2%	4.0	c.c.	ʒi
Compound Tincture of Cardamom (Tinctura Cardamomi Composita)	4.0–8.0	c.c.	ʒi–ii

The following aromatic drugs are used mainly as vehicles or excipients for other drugs, and as flavoring substances.

AMYGDALA AMARA (Bitter Almonds). This is occasionally used as a carminative.

The preparations usually given are:

Bitter Almond Spirits (Spiritus Amygdalae Amarae)	1.0–4.0 c.c.	m. xv–ʒi
Syrup of Bitter Almonds (Syrupus Amygdalae Amarae)	2.0–4.0 c.c.	ʒ½–i

Bitter almonds contain a glucoside **amygdalin** which, when acted upon by a ferment **emulsin**, which it contains, hydrocyanic or prussic acid, is formed. This never occurs in the ordinary preparations, but when any of the preparations of bitter almonds are rubbed together with other preparations prussic acid may be formed. Cases of hydrocyanic acid poisoning have occurred from mixtures which were prepared in this way.

MENTHA PIPERITA (Peppermint Leaves)

Oil of Peppermint (Oleum Menthae Piperitae)	0.06–0.3 c.c.	m. i–v
Spirits of Peppermint (Spiritus Menthae Piperitae)	4.0–8.0 c.c.	ʒi–ii
Peppermint Water (Aqua Menthae Piperitae)		

MENTHA VIRIDIS (Spearmint Leaves)

Oil of Spearmint (Oleum Menthae Viridis)	0.06–0.3 c.c.	m. i–v
Spirits of Spearmint (Spiritus Menthae Viridis)	4.0 –8.0 c.c.	ʒi–ii
Spearmint Water (Aqua Mentha Viridis)		

CINNAMOMI CORTEX (Cinnamon Bark)

Oil of Cinnamon (Oleum Cinnamomi)	0.06–0.3 c.c.	m. i–v
Cinnamon Spirits (Spiritus Cinnamomi)	4.0 –8.0 c.c.	ʒi–ii
Cinnamon Water (Aqua Cinnamomi)		

FLAVORING SUBSTANCES

The following drugs act like the carminatives, because of volatile oils which they contain. They are used principally as flavoring agents.

AURANTII DULCIS CORTEX (Sweet Orange Peel)

AURANTII AMARI CORTEX (Bitter Orange Peel)

Oil of Orange Peel 0.06–0.3 c.c. m. i–v
(Oleum Aurantii Cortex)

Fluidextract of Bitter Orange Peel 1.0 –2.0 c.c. m. xv–xxx
(Fluidextractum Aurantii Amari)

Compound Spirits of Orange Peel 4.0 –8.0 c.c. ʒi–ii
(Spiritus Aurantii Amari)
(Containing the oil of Orange Peel, Lemon, Coriander and Anise)

Tincture of Sweet Orange Peel 4.0 –8.0 c.c. ʒi–ii
(Tincture Aurantii Dulcis)

Tincture of Bitter Orange Peel 4.0–8.0 c.c. ʒi–ii
(Tincture Aurantii Amari)

ROSA GALLICAE PETALAE (Red Rose Petals)

Oil of Rose gtts. i–ii
(Oleum Rosae)

Rose Water
(Aqua Rosae)

Strong Rose Water
(Aqua Rosae fortior) twice as strong

Unguentum Aqua Rosae
(Cold Cream)

ROSEMARY, a drug obtained from the fresh flowering tops of **Rosemarinus officinalis.**

Oil of Rosemary gtts. i–ii
(Oleum Rosemarini)

Spirits of Rosemary 4.0–8.0 c.c. ʒi–ii
(Spiritus Rosemarini)

It is used principally as a local application for the skin.

CARYOPHYLUS, Cloves. The oil of cloves, oleum caryophilis is the preparation commonly used. It is applied on a piece of cotton for toothache, the cotton being placed in the cavity of the tooth.

ANISE, the fruit of the **Pimpinella anisum,** a European plant.

Oil of Anise (Oleum Anise)	0.3–1.0 c.c.	m. v–xv
Spirits of Anise (Spiritus Anisi)	4.0–8.0 c.c.	ʒi–ii

Anise is an ingredient of the Liquor ammonii anisatus of the German pharmacopoeia. It is a very commonly used expectorant among German physicians.

LAVANDULA (Lavender Flowers)

Oil of Lavender Flowers (Oleum Lavandulae Foliorum)	0.3–1.0 c.c.	m. v–xv
Spirits of Lavender (Spiritus Lavandulae)	4.0–8.0 c.c.	ʒi–ii
Compound Tincture of Lavender (Tincture Lavandulae Composita) (Lavender, Rosemary, Cinnamon, Nutmeg)	4.0–8.0 c.c.	ʒi–ii

Oil of cajuput is the volatile oil obtained by distilling the leaves of the **Melaleuca leucadendron,** a tree which grows in the Molucca Islands.

Oil of Cajuput (Oleum Cajuputi)	0.3–1.0 c.c.	m. v–xv

The oil of cajuput has been used in the treatment of parasitic skin diseases, and of round worms.

GAULTHERIA (Wintergreen)

Gaultheria is used principally in the treatment of rheumatism, on account of the methyl salicylate which it contains, and its actions will be considered with these drugs.

The following preparations are used as carminatives:

Oil of Wintergreen (Oleum Gaultheriae)	0.3–1.0 c.c.	m. v–xv
Spirits of Wintergreen (Spiritus Gaultheriae) 5% of the oil	0.6–2.0 c.c.	m. x–xxx

JUNIPER (Juniper Berries)

Oil of Juniper (Oleum Juniperi)	0.3–1.0 c.c.	m. v–xv
Spirits of Juniper (Spiritus Juniperi)	4.0–8.0 c.c.	ʒi–ii
Compound Spirits of Juniper (Spiritus Juniperi Compositus)	4.0–8.0 c.c.	ʒi–ii

Contains oil of juniper, caraway, and fennel

Juniper has been frequently used to increase the flow of urine (diuretic)

Other less important drugs used as flavoring substances are:

MARRUBIUM, Horehound, the leaves and tops of the plant being used. It is used extensively as an expectorant.

LIMONIS CORTEX, Lemon Peel.
SASSAFRAS, Sassafras Bark.
FOENICULUM, Fennel.
PIMENTA, Allspice.
CARUM, Caraway Seeds.
MYRISTICA, Nutmeg.

VANILLA, the unripe fruit of the **Vanilla planifolia.** Of these substances the oil, the spirit, and waters are official.

Of vanilla the tincture is the most common official preparation used.

COMPOUNDS OF VARIOUS VOLATILE OILS

Aromatic Powder (Pulvis Aromaticus)	0.3–2.0 gms.	grs. v–xxx

(Contains cinnamon, cardamom, nutmeg and ginger in powder form)

Fluidextract of Aromatic Powder 0.5–2.0 c.c. m. viii–xxx
(Fluidextractum Aromaticus)

Aromatic Elixir

Elixir Aromaticum and **Elixir Adjuvans** are preparations of the compound spirits of orange peel used as flavoring agents.

Other preparations used as carminatives are the **Chloroform water, Hoffman's anodyne (Compound spirits of ether),** and a number of alcoholic preparations, such as curacoa, Cherrywater (kirschwasser) kummel, whiskey, rum, gin, etc.

DIGESTANTS

In cases where the stomach is so affected, that it secretes very little gastric juice, the patient is unable to digest his food.

In such cases the digestion of the food can be assisted by giving various ferments which digest the various food substances, such as proteids, carbohydrates and fats, and which take the place of the gastric or intestinal juices which may be very much diminished or absent.

Substances Used for Digestion of Carbohydrates

Carbohydrates are starchy foods, such as bread, potatoes, and sugars.

The starchy foods are partially digested in the mouth. They are changed to sugars by the saliva, which contains a ferment **ptyalin.** The digestion of the starchy foods and sugars is completed in the intestines, by the pancreatic juice, which contains the starch digesting ferment **amylopsin.**

Malt

Malt is barley grain which has begun to grow artificially. The growth is then stopped by means of heat.

During this growth the starch contained in the barley, is changed to sugar by means of a ferment which is contained in the barley grain. This ferment is called **diastase.**

Malt which contains this ferment diastase, is often given to help the digestion of starches. Many of the preparations used, contain no diastase, and produce no digestive effects; though they are easily digested foods. Many of the malt extracts contain alcohol, and are therefore similar to beer or stout.

Preparations

Extract of Malt (Extractum Malti)	16.0 gms.	℥iv

A syrupy extract of malt.

Unofficial Preparations

Maltine
Maltzyme and others

Taka Diastase

A starch digesting ferment produced by the action of a mould (Eurotium oryzae) upon wheat bran. It is named after its discoverer, Takamine, a Japanese.

Taka diastase is very powerful and efficient, and also acts in the stomach before the normal amount of acid is produced.

The action of starch digesting ferments are usually destroyed by the acid in the stomach.

Substances Used for the Digestion of Proteids

Proteids are food substances such as meat and eggs. Milk also contains a large proportion of proteids.

The proteids are partially digested by the gastric juice; which consists mainly of pepsin and hydrochloric acid. Pepsin can only act in the presence of an acid.

The proteids are completely digested by the pancreatic juice; which contains **trypsin,** a ferment which digests proteids completely; **amylopsin,** a ferment which digests starches completely, and **steapsin,** a ferment which breaks up the fats into very small globules (emulsifies).

Pancreatic juice can only act in the presence of an alkali, and is destroyed by an acid, such as the acid in the stomach.

PEPSIN

Pepsin is a ferment obtained from the lining membrane of fresh stomachs of healthy pigs. It is used to aid digestion in cases where there is a diminished amount of gastric juice in the stomach.

It only acts with an acid; and should always be given with dilute hydrochloric acid. Alkalies destroy its activity, and it should therefore never be given with such substances as sodium bicarbonate.

Preparations

Pepsin (Pepsinum)	0.3–0.6 gm.	grs. v–x

The following unofficial preparations are often used:

Essence of Pepsin (Essentia Pepsini)	8.0	c.c.	ʒii
Glycerite of Pepsin (Glyceritum Pepsinae)	3.0	c.c.	m. xlv

And the elixir of pepsin and pepsin solution.

New and Non-official Preparations

Elixir of Enzymes	4.0–8.0	ʒi–ii

This is a solution containing pepsin and rennet in 20% of alcohol.

Rennet

Rennet is a ferment secreted by the mucous membrane of the stomach. It curdles milk.

New and Non-official Preparations

Pegnin
Milk Sugar Rennet

About 8.0–10.0 gms. (ʒii–iiss) of pegnin are added to 1000 c. c. of cool boiled milk. The mixture is then allowed to stand for two or three minutes, and is shaken until the clot which had been formed is uniform in consistency. This forms a finely divided clot and makes the milk easier to digest.

PANCREATIN

Pancreatin is a mixture of all the ferments obtained from the fresh pancreatic glands of the pig. It is used principally to predigest foods, before they are given to the patient, in cases where the patient is unable to digest food.

Pancreatin can only act in the presence of an alkali, and must always be given with sodium bicarbonate.

It is seldom given internally, as it is destroyed by the hydrochloric acid in the stomach.

When it is given internally, it should be given in pills coated with keratin, which is not acted upon by the acid of the gastric juice, but is dissolved by the alkaline intestinal juices.

Preparations

Pancreatin (Pancreatinum)	0.1–0.3 gm.	grs. ii–v

Unofficial Preparations

Peptonizing Powder (Pulvis Pancreaticus Compositus)

This is used to predigest foods such as milk and eggs. Each powder consists of 5 grains of pancreatic extract, and 15 grains of sodium bicarbonate.

METHOD OF PEPTONIZING MILK

Partially Peptonized Milk:

To a bottle containing one pint of milk and 4 ounces of water, add one peptonizing powder. Keep the bottle at a temperature of 105 degrees to 115 degrees (Fahrenheit). This is best done by placing it in hot water of that temperature, for about 20 minutes to a half hour. The milk should then have a slightly bitter taste. Part of the proteids of the milk are digested by this method.

Completely Peptonized Milk:

The method for complete peptonization, is the same as for partial peptonization, but it is continued for two hours, during which time all the proteids are completely digested. Completely peptonized milk has an extremely bitter taste.

Diazyme Essence	4.0–8.0 c.c.	ʒi–ii

This is a liquid containing all the amylopsin of the pancreas. It is used to digest starchy foods, when these are not readily digested by the saliva or pancreatic juice.

Diazyme Glycerole	4.0–8.0 c.c.	ʒi–ii

This acts like the diazyme essence.

Glycerole Trypsin: By mouth 4.0–8.0 c.c. ʒi–ii

Hypodermically 0.3 c. c. (m. v.) every other day.

This preparation is given by mouth, or hypodermically for the treatment of cancer. It is supposed to digest the cancer cells.

Holadin: One capsule, three hours after meals. Each capsule
(Extractum Pancreaticum Integrum) contains 0.2 gm. grs. iii

This is an extract of the pancreatic glands which contains all the enzymes; trypsin, amylopsin and steapsin; and a milk curdling ferment. It is used in diseases where the food is not well digested.

Panase 0.12–0.3 gm. grs. ii–v

This is a combination of the digestive ferments of the pancreas, derived from the pancreatic gland of the pig. It is used where digestion is poor.

Pankreon 0.25–1.0 gm. grs. iv–xv
Tannin Pancreatin Compound for children 0.06–0.25 gm. grs. i–iv

This is a mixture containing the trypsin, amylopsin and steapsin of the pancreatic juice, and about 8% of tannin.

The action takes place in the intestines, and it aids digestion in diseases where the food is not thoroughly digested, because of deficient action of the pancreas. It is also used in diarrhoea, dysentery, marasmus, etc.

Trypsin 0.12–0.3 gm. grs. ii–v

This is the proteid digesting ferment of the pancreas.

It is applied in solutions containing sodium bicarbonate, to diphtheritic, or other membranes. It is also given hypodermically, in cases of cancer, to digest the cancer cells.

Ingluvin (Not official) 0.3–1.0 gm. grs. v–xv

Ingluvin is the extract of a fowl's gizzard, and is occasionally used to aid in the digestion of proteids.

Papain

Papain the fruit of the **Carica papaya,** a tree growing in tropical countries. The juice of this fruit contains a ferment **papain, papayotin** or **papoid** which is used to aid the digestion of proteids.

EMETICS

Drugs which Produce Vomiting

Vomiting is an act by which the stomach violently empties its contents. The strain of continued vomiting, usually makes the patient very weak, and often produces symptoms of collapse.

The patient is then very pale, his skin is cold and covered with perspiration, his pulse is rapid, weak and thready, and he breathes slower and shallower, and his pupils are dilated. The patient usually complains of great weakness.

Drugs Produce Vomiting in Two Ways

1. By greatly increasing the activity of the lining membrane of the stomach (irritating), the muscular wall of the stomach contracts very forcibly, and empties the stomach of its contents.

2. Some drugs after being absorbed into the blood, are carried by the circulation, to an area of gray matter in the medulla of the brain, and cause this part of the brain, whose function is to produce vomiting (the vomiting center), to send impulses to cause the muscle wall of the stomach to contract, and thereby produce vomiting.

IPECAC

A drug obtained from the roots of the **Cephaelis ipecacuanha**, a wild plant growing in Brazil, Colombia and other parts of South America.

Its active principles are the **alkaloids.**

Emetine
Cephaeline
Psychotrine

Appearance of the Patient

If a patient is given a moderately large dose of one of the preparations of ipecac, a very short time after the ad-

ministration, he feels nauseated and vomits profusely. The vomiting is usually accompanied by profuse secretion of saliva, of tears, and of mucus from the bronchi. Occasionally, if the entire amount of drug is not completely excreted in the vomited matter, it may cause profuse diarrhoea and symptoms of mild collapse; rapid pulse, slower respiration, and cold moist skin.

ACTION

Local Action: On the skin it produces redness, itching and small pustules.

On the mucous membranes: On the eye it causes redness and swelling with profuse flow of tears. In the nose it causes redness and profuse secretions and continual sneezing.

Internal Action

In the mouth: It increases the flow of saliva, and reddens the lining membrane.

In the stomach: Ipecac acts principally on the lining membrane of the stomach, causing redness and swelling (irritation) with an excessive secretion of gastric juice, and mucus. This causes the muscle wall of the stomach to contract violently, thereby producing vomiting. The vomiting continues, until all the ipecac in the stomach is entirely expelled.

In the intestines: The action on the intestinal tract is similar to that in the stomach, the lining membrane becomes red, swollen and secretes an excessive amount of mucus, thereby producing contractions of the muscle wall of the intestines which results in profuse diarrhoea. The stools often contain blood, from the excessive irritation.

Action after Absorption

Some of the ipecac is rapidly absorbed from the stomach. Ipecac then acts principally on all the mucous membranes. On the mucous membrane of the bronchi, it causes a profuse secretion of mucus. (It is commonly given for this effect, especially to children, in cough mixtures; to increase the expectoration).

On the mucous membrane of the eye and nose it produces the same effects as when applied locally.

The symptoms of collapse, which occasionally result after large doses of ipecac, are usually due to the great strain of continual vomiting.

Excretion

Ipecac is usually excreted by the stomach in the vomited matter, and does not therefore produce any poisonous symptoms.

Preparations

Solid Preparations:

Powdered Ipecac, as emetic	2.0 gms.	grs. xxx
(Pulvis Ipecacuanhae) as expectorant	0.06–0.3 gm.	grs. i–v
Powdered Ipecac and Opium (Pulvis Ipecacuanhae et Opii) (Dover's powder) (Contains 10% opium and 10% ipecac)	0.3 –1.0 gm.	grs. v–xv

Fluid Preparations:

Fluidextract of Ipecac, as emetic	1.0–2.0 c.c.	m. xv–xxx
(Fluidextractum Ipecacuanhae) as expectorant	0.2–0.5 c.c.	m. iii–viii

The following two preparations are given mostly to children.

Syrup of Ipecac, for infant as emetic	2.0–4.0 c.c.	ʒ½–i
(Syrupus Ipecacuanhae) as expectorant (7% of fluidextract)	0.1–1.0 c.c.	m. ii–xv
Wine of Ipecac, for a child as emetic	2.0–4.0 c.c.	ʒ½–i
(Vinum Ipecacuanhae) as expectorant (10% of fluidextract)	0.1–1.0 c.c.	m. ii–xv

Active Principles

Emetine (not official)	0.005–0.01 gm.	gr. $\frac{1}{12}$–$\frac{1}{6}$

Administration

If given to produce vomiting, it is best to dilute the preparations in warm water.

If given as an expectorant, especially to croupy children, the preparations should be given undiluted.

APOMORPHINE

Apomorphine is an artificial alkaloid, made from morphine, one of the alkaloids of opium, by adding an acid to it, to take out some of the water that the morphine contains (such a process is called dehydration).

Appearance of the Patient

When a moderate dose of apomorphine is administered hypodermically, within ten to fifteen minutes after it is given, the patient feels very nauseated and vomits profusely. At the same time, there is profuse secretion of tears, mucus from the nose and bronchi, and cold perspiration. These symptoms are always produced by any drug which causes vomiting. There is usually a great deal of weakness after apomorphine, at times very profound collapse; a rapid thready pulse, slow and shallow respiration, cold perspiration and dilated pupils. The collapse however, has seldom been fatal.

ACTION

Apomorphine has no local action.

Internally: Small doses of apomorphine often increase the secretions of all the mucous membranes without producing vomiting, and they are often given for this effect.

Mode of action: Apomorphine produces vomiting, by causing the vomiting center in the brain to send impulses to the stomach to cause its muscle wall to contract and thereby expel its contents.

Excretion: It is excreted by the stomach in the vomited matter.

Preparations

Apomorphine Hydrochloride, as

emetic,	0.006–0.012 gm.	gr. $\frac{1}{10}$ – $\frac{1}{5}$

(Apomorphinae Hydrochloridum)

as expectorant	0.002–0.004	grs. $\frac{1}{30}$ – $\frac{1}{15}$

Apomorphine is usually given hypodermically.

SINAPIS—MUSTARD

There are two kinds of mustard:

Sinapis Alba (White Mustard)
Sinapis Nigra (Black Mustard)

Mustard is the powdered dried ripe seeds of **Brassica alba** and **Brassica nigra**, which are European plants growing in temperate climates, throughout the world.

Black mustard is usually much stronger than the white.

ACTION

Local Action: Applied to the skin, mustard causes redness, and the skin feels warm (rubefacient action), because it widens the capillaries. If the application is left on for a long time, or if the preparation is very strong, blisters are formed (vesicant action). If the application is kept on for a still longer time, pustules may form, and the skin may even be destroyed at the spot of application (escharotic action).

Internal Action

In the stomach, small quantities of mustard increase the appetite and the secretion of gastric juice, and therefore aid the digestion of food. For this purpose, mustard is never prescribed, but it is commonly used as a condiment with food.

In doses in which mustard is usually prescribed, it produces nausea and vomiting, and is used extensively for this purpose, especially in cases of poisoning from various drugs.

Since it produces vomiting in moderate doses, mustard is not absorbed, and produces no other effects, than those due to the vomiting.

Preparations

White Mustard powder
(Sinapis Alba)

Black Mustard powder
(Sinapis Nigra)

Mustard Paper, or **mustard plaster**
(Charta Sinapis)

This consists of black mustard powder, to which India rubber is added to make it more adhesive, and the mixture is then applied to sheets of paper and dried.

The active principles of **black mustard** are **sinigrin,** a glucoside, and **myrosin,** a ferment.

When water is added to black mustard, it is decomposed; the myrosin acts on the sinigrin and changes it to dextrose, a sugar, and the volatile oil of mustard, which is the active ingredient.

The active principles of **white mustard** are **sinalbin,** a glucoside, and a ferment **myrosin.**

When water is added to white mustard it is decomposed. The myrosin acts on the sinalbin, changing it to dextrose, a sugar, and an alkaloid, sinapine sulphate.

Mustard paste is commonly used as a local application to cause redness of the skin over which it is applied, in order to draw blood from the deeper tissues or organs (counter irritant). It is usually made up with flour, usually one part of mustard to four parts of flour is used. It must be made up with tepid water, as hot water, alcohol and vinegar, destroy the oil which is formed and which is the active ingredient; so that no effect is then produced from the application.

Methods of Administration

For Local Applications:

(1) **The plaster** dipped in lukewarm water is used.

(2) **Mustard paste:** This should not be applied directly to the skin, but through a piece of thin gauze or lint.

(3) **Powdered mustard** may be sprinkled over an ordinary poultice, and the poultice then applied to the skin.

Local applications of mustard should not be left on longer than fifteen to thirty minutes.

Mustard Baths are common methods of administering

mustard for a local effect, and to relieve congestion of internal organs. About two to four teaspoonfuls of the dried powder are added to each gallon of water.

To produce vomiting, a teaspoonful to a tablespoonful of the mustard powder is given in tepid water, and is repeated in fifteen to twenty minutes if no effects were produced.

Poisonous Effects

Large doses of mustard cause violent pain in the abdomen, with profuse vomiting and diarrhoea, and as a result of this, the symptoms of collapse; cold moist skin, pallor, rapid thready pulse, shallow breathing, and dilated pupils.

ANTIMONY

Antimony is a metal. Many of its preparations are used in medicine, principally to produce vomiting.

ACTION

Applied to the skin, antimony causes redness, and in strong solutions it produces blisters or pustules.

When given internally, it causes profuse continuous vomiting and it increases the secretions of all the mucous membranes and the sweat. On account of the collapse which follows its use, it is not often used.

Overdoses usually cause profuse vomiting and diarrhoea, with profound collapse.

Preparations

Tartar Emetic, as a diaphoretic	0.002–0.008 gm.	grs. $\frac{1}{30}$ – $\frac{1}{8}$
Antimonii et Potasii Tartaras as an emetic	0.03 –0.1 gm.	grs. $\frac{1}{2}$ – ii

This preparation is also contained in the compound syrup of squills.

Wine of Antimony, as a diaphoretic	0.6– 2.0 c.c.	m.x–xxx
Vinum Antimonii as an emetic	4.0–15.0 c.c.	ʒi–iv

Contains 4 parts of Tartar Emetic to 1000.

Other drugs used to produce vomiting, are:

Zinc Sulphate	0.6–2.0 gms.	grs. x –xxx
Copper Sulphate	0.2–0.3 gm.	grs. iii–v

Copper sulphate is the best emetic to use in cases of Phosphorus poisoning.

Alum	4.0 gms.	℥i

Alum is best given in molasses or in the syrup of ipecac.

Turpeth Mineral (Yellow Mercurous Subsulphate)

Hydrargyri Subsulphas Flavus (not official)	0.06–0.3 gm.	grs. i–v

It is given every ten or fifteen minutes until free vomiting occurs.

Other substances used to produce vomiting are **warm water** given continuously until vomiting is produced.

Salt (sodium chloride) is given in solid form or in concentrated solutions.

CHAPTER VII

INTESTINAL STIMULANTS

CATHARTICS

Cathartics are drugs which are used to move the bowels. Many drugs which produce various effects on the different organs of the body, may also increase the movements of the bowels, but the drugs here considered, are those which are principally used to produce movements of the bowels.

Movements of the bowels are brought about by the contractions of the involuntary muscles of the intestines (peristalsis).

This is caused,

1. By the intestines filling up with either solid, fluid or gaseous matter, which is then expelled by the contractions of the intestinal muscles which the distention produces.

2. By drugs which cause redness and swelling of the mucous membrane of the intestines (irritation). This not only causes an increased secretion of mucus, which helps to fill up the intestines, but also affects the nerve endings in the wall of the intestines.

Impulses are thus sent along the nerve fibers to the spinal cord, which immediately sends back other impulses to the intestinal muscles to cause them to contract, and thus helps to expel the intestinal contents. (Such an action is called a reflex action).

Frequent movements of the bowels are often accompanied by violent cramp-like pains in the abdomen (griping), due to the violent contractions of the involuntary muscles of the intestines which accompany such movements.

To overcome the griping, many cathartics are often combined with other drugs which lessen intestinal peristalsis.

For example—Lapactic pills are commonly used cathar-

tics which are very efficient. They contain the extract of belladonna to overcome the griping which they might otherwise produce.

3. Many cathartics, like the salines, draw fluid into the intestines from other tissues and from the blood; thereby filling up the intestines with fluid which is expelled by the resulting contractions of the intestinal muscles.

At the same time, this removes fluids from other tissues and from the blood, so that oedema (fluid in the tissues) may be lessened and the blood pressure reduced.

Saline cathartics are often given to produce these effects.

Administration

Cathartics which produce mild effects, or which produce their effects slowly, should be given at night.

Those which produce rapid effects, should be given in the morning.

Cathartics which cause violent action should not be given in cases where the intestine is diseased.

For example—In **typhoid fever** or **acute appendicitis** violent cathartics should be avoided. In typhoid fever an active cathartic may increase the inflammation in the ulcers which are present in the intestinal mucous membrane in this disease. The violent contractions which such a cathartic produces, may increase the tendency to haemorrhage and perforation.

In cases of **acute appendicitis** the appendix may be very friable, and the violent contractions which many cathartics produce, may cause a rupture of the appendix.

In cases that have had an abdominal operation performed upon them, **the nurse should never administer a cathartic without the doctor's order.**

When the operation has been performed upon the stomach or intestines, such operations as the removal of the vermiform appendix, the removal, or suturing (sewing) of a part of the stomach and intestines, the greatest care must be exercised in giving cathartics. **In such cases no cathartic should be administered before the third day after the operation,** because the violent intestinal contractions may tear

the delicate stitches in the wall of the intestines, and cause perforations with resulting peritonitis, and even fatal results.

Cathartics are divided into three classes, depending upon whether they cause **mild action, moderate action, and more violent action.**

The distinction is not very well defined; as some cathartics produce mild effects in small doses, and greater, even violent effects in larger doses, but the classification here given, is according to the effects produced by the doses that are usually administered.

1. **Laxatives**
2. **Purgatives** (Vegetable and Saline Purgatives)
3. **Drastic Purgatives**

1. **Laxatives** or **Aperients**: Laxatives are medicines which cause a few movements of the bowels. The stools are formed, normal in character, and the movements are not accompanied by griping.

LAXATIVES

Many foods which leave a great deal of residue or undigested material, after they are digested, act as laxatives. Such foods as oatmeal, wheat, bran and many fruits are distinctly laxative. The most common laxatives used are:

Molasses
(Syrupus Fuscus)

Milk Sugar
(Saccharum Lactis)

MANNA: Manna is a drug obtained from the sap of the European ash tree which grows chiefly in Sicily and Calabria.

Dose: 15.0–60.0 gms. ʒ½–ʒii

Manna is used as a mild laxative, very often combined with other purgatives.

FRANGULA: Frangula is obtained from the bark of the **European buckthorn** or **Rhamnus frangula.**

Preparations

Fluidextract of Frangula (Fluidextractum Frangulae)	1.0–2.0 c.c.	m. xv–xxx

Frangula contains an active principle **frangulin,** a glucoside.

CASCARA: Cascara sagrada is obtained from the bark of the California buckthorn. Its official name is **Rhamnus purshianae.** It contains an active principle **purshianin,** a glucoside.

Preparations

Extract of Cascara Sagrada (Extractum Rhamni Purshianae)	0.25 gm.	grs. iv
Fluidextract of Cascara Sagrada (Fluidextractum Rhamni Purshianae)	1.0 c.c.	m. xv

Cascara is one of the best laxatives. It is usually given at night, and produces a normal stool the next morning without griping. It is often given for habitual constipation.

FEL BOVIS or ox gall: Fel bovis is dried bile, obtained from the ox. It is used as a mild laxative and to increase the flow of bile.

Preparations

Purified Ox gall (Fel Bovis Purificatum)	0.3–1.2 gm.	grs. v–xx

EUONYMUS: Euonymus or Wahoo, is the bark of the **Euonymus atropurpureus,** the spindle tree, growing in America. It is used as a mild laxative.

Preparations

Extract of Euonymus (Extractum Euonymi)	0.06–0.2 gm.	grs. i–iii
Fluidextract of Euonymus (Fluidextractum Euonymi)	0.5 c.c.	m. viii

LEPTANDRA: Leptandra is obtained from the roots and underground roots of the **Veronica virginia,** an American plant.

It is used as a mild laxative. The stools often contain a great deal of bile after it is given.

Preparations

Extract of Leptandra (Extractum Leptandrae)	0.1–0.25 gm.	grs. ii–iv
Fluidextract of Leptandra (Fluidextractum Leptandrae)	2.0–4.0 c.c.	m. xxx–ʒi

TAMARIND: Tamarindus or tamarind is the preserved fruit of the **tamarindus indica**, a tree growing in the East or West Indies. It is eaten like preserves, and is a very good laxative.

CASSIA FISTULA: Cassia fistula, or purging cassia, is the fruit of the cassia fistula tree of East India and Egypt. It is used as a laxative in doses of

4.0–30.0 c.c. ʒi–ʒi

SULPHUR (Brimstone) is an inorganic element found in volcanoes. Many of its preparations are used as laxatives.

Washed Sulphur (Sulphur Lotum)	1.0–4.0 gms.	grs. xv–ʒi
Precipitated Sulphur (Sulphur Praecipitatum)	4.0–15.0 gms.	ʒi –iv
Sublimed Sulphur, or flowers of Sulphur (Sulphur Sublimatum)	4.0–15.0 gms.	ʒi –iv

Sulphur is best given in syrup.

Glycerin

Glycerin (Glycerinum)

Glycerin in doses of one to two ounces is a very good laxative.

Olive Oil

Olive Oil (Oleum Olivae)

Olive oil in doses of a wineglassful acts as a very good laxative. It is said to increase the flow of bile.

Plenty of water is also a very good laxative.

PURGATIVES

Purgatives are drugs which produce frequent movements of the bowels, with soft stools accompanied by griping.

There are two kinds of purgatives.

1. **Vegetable purgatives:** Vegetable purgatives are vegetable substances causing frequent movements of the bowels.

2. **Saline purgatives:** Saline purgatives are inorganic (mineral) salts used as purgatives.

These are often called **hydragogue cathartics** because they produce very frequent watery stools.

Many purgatives are also called **cholagogue cathartics** because the stools which they produce are highly colored with bile. This is due to the fact, that they act mainly on the duodenum or first part of the small intestine, and therefore also bring about contractions of the bile ducts, so that more bile is poured into the intestine. They do not increase the secretion of bile.

VEGETABLE PURGATIVES

Large doses of the laxatives act as purgatives.

CASTOR OIL—OLEUM RICINI

Castor oil is a fixed oil (an oil which does not evaporate), obtained from the seeds of the **Ricinus communis,** a tree growing in all warm countries. The seeds are warmed, and the oil is then pressed out of them. The oil ordinarily used, is obtained from Calcutta in India.

Castor oil has no odor, but a very unpleasant nauseating taste.

The active principle of castor oil is **ricinoleic acid,** and its compounds **ricinoleates.** These are formed in the stomach when castor oil is given. Old castor oil contains more ricinoleic acid, and is therefore often more efficacious.

ACTION

Local Action: On the **skin** and **mucous membranes,** castor oil is very soothing.

Internal Action

In the mouth: It has an unpleasant nauseating taste. Even the smell of it will sometimes produce nausea.

In the intestines: Castor oil produces in about three to six hours, frequent movements of the bowels, not accompanied by griping. The stools are soft, and after the movements have occurred, the bowels are apt to be constipated.

The castor oil is decomposed by the digestive juices, so that ricinoleic acid and its compounds are formed (ricinoleates). These substances slightly increase the intestinal secretions, and affect the nerve endings of the intestinal wall. Impulses are thus sent to the spinal cord, to bring about contractions of the muscle wall of the intestines, thereby causing frequent movements of the bowels (reflex action).

The ricinoleates which are formed in the intestine, are absorbed into the blood, and are then excreted by all the secretions, including the milk, so that castor oil often acts as a laxative on nursing infants.

Castor oil is one of the best cathartics for temporary use; because of its soothing after effect which produces constipation.

Preparations

Castor Oil (Oleum Ricini)	15.0–30.0 c.c.	ʒ ½–i
For an infant	4.0– 8.0 c.c.	ʒ i–ii

Laxol: This is a tasteless preparation of castor oil (not official).

Castor oil is also put up in flexible capsules, to disguise its unpleasant taste.

(The castor oil bean contains a very poisonous substance, ricin, which is never used.)

Administration

On account of its unpleasant taste, castor oil must be given very carefully.

To some people, however, the taste of castor oil is not

at all unpleasant. For example: the Chinese are very fond of castor oil and do not mind its unpleasant taste, in fact, they use it as a food.

Methods of Administration

1. To children or even to some adults, it may be given in warm sweetened milk.
2. It may be poured in an equal quantity of glycerin and given in this manner.
3. It is often given in hot coffee.
4. In soda water its taste can often be easily disguised.
5. It is often given in brandy.

The best method, however, is the following:

Castor Oil Cocktail

Rinse out the medicine glass with some whiskey or lemon juice, and pour about a teaspoonful of whiskey or lemon juice in the bottom of the glass. The castor oil is then added; and on top of that, another teaspoonful of whiskey, raspberry juice or peppermint. The mixture is then given to the patient.

The patient's mouth may be rinsed out with a little whiskey or peppermint, before giving the castor oil.

A little vichy or seltzer, or an olive, will often remove the unpleasant nauseous feeling which follows the taking of a dose of castor oil, even when its taste is disguised.

CALOMEL: HYDRARGYRI CLORIDI MITE

Calomel is a compound of mercury; the mild mercurous chloride.

ACTION

Calomel is used principally as a purgative. It produces frequent soft stools, very highly colored with bile, and it is often called therefore, a cholagogue cathartic.

It acts principally on the duodenum; the first part of the small intestine. It acts as an antiseptic in the intestines, checking the growth of bacteria. It also causes redness, and

increased secretion of the lining membrane of the intestines (irritation), which brings about contractions of its muscle wall (peristalsis). The contractions of the intestinal muscle wall, induce contractions in the bile ducts, which are closely attached to the duodenum or first part of the small intestine. These contractions increase the flow of bile into the intestine, so that the stools produced by calomel, contain a great deal of bile.

Calomel has a decided tendency to produce griping.

It is also used to increase the flow of urine. (diuretic)

Preparations

Calomel	0.008–0.3 gm. gr. $\frac{1}{8}$–v
(Hydrargyri Chloridi Mite)	

Administration

Calomel may be given in small doses, frequently repeated. For example—$\frac{1}{4}$ of a grain every fifteen minutes until two grains are taken, or the two grains may be given in one single dose.

It is often given with sodium bicarbonate; about five grains of sodium bicarbonate with every half grain dose of calomel. This lessens the griping, and also neutralizes the action of the acid in the stomach, which often changes calomel (mild mercurous chloride) to corrosive sublimate (bichloride of mercury) which is a distinct poison.

Calomel should always be followed by a dose of one of the saline cathartics, to expel it; as it might otherwise remain in the intestines and be changed into corrosive sublimate which may then cause poisonous symptoms. These symptoms are: A metallic taste in the mouth, abdominal pain, nausea, vomiting, diarrhoea with bloody stools, and collapse (rapid weak thready pulse, slow shallow respiration, cold moist skin, dilated pupils).

BLUE MASS—MASSA HYDRARGYRI

This is a compound of mercury and is a milder purgative than calomel. It is always given in pill form, each pill containing about three to five grains of the blue mass.

Blue Mass (Massa Hydrargyri)	0.06–0.3 gm.	grs. i–v

MERCURY WITH CHALK, GRAY POWDER, HYDRARGYRUM CUM CRETA

This preparation is made of metallic mercury, with chalk and honey.

It is always prescribed in powder form. It is milder than calomel. The chalk lessens the griping.

RHUBARB

Rhubarb is obtained from the root of the **Rheum officinale,** a plant growing in China and Tartary.

ACTION

In the stomach: Rhubarb increases the secretion of gastric juice, thereby aiding digestion, and increasing the appetite. **In the intestines** rhubarb acts as a purgative, producing frequent fluid stools, not accompanied by griping. These stools are colored with a great deal of bile.

On account of the tannic acid which it contains, rhubarb constipates after its purgative action.

The urine, and in nursing women, the milk, is colored yellow when rhubarb is taken.

Rhubarb is particularly valuable in cases where solid masses in the stools produce pain. For example, in haemorrhoids, by softening the stools, the pain produced by the passage of hard fecal masses, is often relieved.

Preparations

Extract of Rhubarb (Extractum Rheii)	0.3–0.6 gm.	grs. v–x
Fluidextract of Rhubarb (Fluidextractum Rheii)	1.0–2.0 c.c.	m. xv–xxx
Compound Rhubarb Pill (Pilulae Pheii Compositae)	1 –5 pills	

(Contains aloes, myrrh, oil of peppermint and rhubarb)

Compound Rhubarb Powder (Pulvis Rheii Compositus) (Gregory's powder) (Contains magnesia, ginger and rhubarb)	1.0–4.0 gms.	grs. xv–℥i
Aromatic Tincture of Rhubarb (Tincture Rheii Aromatica)	2.0–8.0 c.c.	ʒ ss–ii
Rhubarb and Soda Mixture (Mistura Rheii et Sodae) (Contains bicarbonate of soda, ipecac, peppermint and glycerin).	4.0–16.0 c.c.	ʒ i –iv
Syrup of Rhubarb (Syrupus Rheii)	2.0– 8.0 c.c.	ʒ ss–ii for a child.
Aromatic Syrup of Rhubarb (Syrupus Rheii Aromaticus)	2.0– 8.0 c.c.	ʒ ss–ii for a child.

ALOES

Aloes is the dried juice of several species of **Aloes,** a plant growing in the Barbadoes, and other islands in the Indian Ocean and in Arabia. It is one of the oldest drugs in medicine. It was used in the time of Alexander the Great, about 300 years B. C.

The preparations used, are the **Barbadoes** and **Socotrine Aloes,** from the Barbadoes, and the Island of Socotra.

Its active principle is a neutral substance, **Aloin.**

ACTION

In the stomach: Aloes increases the secretion of gastric juice, aids digestion and increases the appetite.

In the intestines: Aloes acts principally on the large intestine, causing marked redness, with great dilatation of the blood vessels. This action results in peristalsis of the large intestine.

Aloes therefore causes movements of the bowels, with frequent formed stools.

It also dilates the blood vessels of the other organs in the pelvis, such as the uterus, bringing more blood to these organs, increasing menstruation and often producing abortion.

Administration

Aloes is seldom administered alone. It is usually given combined with other purgatives.

Preparations

Solid Preparations

Purified Aloes (Aloe Purificata) 0.1–0.5 gm. grs. ii–viii

Extract of Aloes (Extractum Aloes) 0.1–0.5 gm. grs. ii–viii

Pills of Aloes (Pilulae Aloe) 1 –5 pills
Each pill contains 0.12 gm. grs. ii of aloes

Pills of Aloes and Iron (Pilulae Aloes et Ferri) 1 –5 pills
Each pill contains 0.12 gm. grs. ii of aloes

Pills of Aloes and Mastiches (Pilulae Aloes et Mastiches) 1 –5 pills
(Lady Webster's dinner pill.) Each pill contains grs. ii of aloes

Pills of Aloes and Myrrh (Pilulae Aloes et Myrrhae) 1 –5 pills
(Rufus pill.) Each pill contains 0.12 gm. grs. ii of aloes

Fluid Preparations

Tincture of Aloes (Tinctura Aloes) 2.0 –8.0 c.c. ℥ss–ii

Tincture of Aloes and Myrrh (Tinctura Aloes et Myrrhae) 2.0 –8.0 c.c. ℥ss–ii

Aloin (active principle) (Aloinum) 0.06–0.25 gm. grs. i –iv

Lapactic Pills or A. B. & S. pills dose 2 pills
Pilulae Laxativae Compositae
Each pill contains,

Aloin	gr. $\frac{1}{4}$
Extract of Belladonna	gr. $\frac{1}{8}$
Strychnine	gr. $\frac{1}{120}$
Powdered Ipecac	gr. $\frac{1}{15}$

Aloes is also contained in the **compound rhubarb pill, compound extract of colocynth,** and **compound tincture of benzoin.**

SENNA

Senna is obtained from dried small leaves of an oriental shrub.

There are two kinds of senna plants, **Cassia acutifolia,** which comes from Alexandria in Egypt and **Cassia angustifolia,** from India. Senna contains several active principles, cathartic acid, chrysophanic acid, sennit and sennacrol

ACTION

Senna acts principally on the large intestines, producing in five hours after it is given, frequent watery stools, usually accompanied by severe griping pains.

To overcome the griping, it is usually combined with other substances, especially carminatives.

It is excreted in the urine. In nursing women it is excreted in the milk, and it will then act as a laxative on the nursing infant.

Senna in small doses is often given to children to produce a laxative effect.

Preparations

Fluidextract of Senna (Fluidextractum Sennae)	4.0–8.0 c.c.	ʒi–ii
Confection of Senna (Confectio Sennae)	4.0–8.0 c.c.	ʒi–ii

Containing senna, cassia fistula, tamarind, prune, fig, sugar and oil of coriander.

Compound Infusion of Senna (Black Draught) (Infusum Sennae Compositum)	30.0–120.0 c.c.	ʒi–iv

Contains senna, manna, magnesium sulphate and fennel.

Syrup of Senna (Syrupus Sennae)	4.0–16.0 c.c.	ʒi–iv

Senna tea is a preparation often given to children. It is an infusion of senna leaves, a teaspoonful of leaves are used to a cup of water.

GLYCYRRHIZA, LICORICE ROOT

Licorice is the root of **Glycyrrhiza glabra**, an English plant. Its active principle is a glucoside, **glycyrrhizin.**

ACTION

Applied to the skin it is soothing and protecting (demulcent). Taken internally it is a mild purgative.

Preparations

Compound Licorice Powder (Pulvis Glycyrrhizae Compositus)	4.0 gms.	ʒ. i

This contains senna, licorice root, sulphur, fennel and sugar. It should be given in very little water, as it often causes nausea, but it should always be followed by a drink of water.

Licorice powder is best given at bedtime. It is an excellent purgative, producing frequent fluid stools without griping, in about ten to fifteen hours; or three to six hours, if given on an empty stomach.

It is especially valuable in patients suffering from haemorrhoids. The fluid stools which licorice powder produces, lessens the pain which movements of the bowels cause in haemorrhoids.

NEW AND NON-OFFICIAL PREPARATIONS

PHENOLPHTALEIN

Phenolphtalein is a chemical substance made from carbolic acid, phthalic anhydride and sulphuric acid.

It is used in the laboratory to test the reaction of various substances; since it turns red when an alkali is added to it.

ACTION

Phenolphtalein acts as a very good purgative, producing frequent soft stools with little griping.

Preparations

Phenolphtalein	0.1–0.2 gm.	grs. ii–iii

In obstinate cases of constipation, it may be given in doses of 0.5 gm. (grs. viii).

It is best given in powders, cachets, capsules or pills.

There are numerous preparations of phenolphtalein on the market which are used as purgatives such as ex lax, chocolax, etc.

AGAR AGAR

Agar agar is a substance extracted from various sea weeds of the East Indies.

It is used as a purgative. It withdraws water from the stomach and intestines, forming a large jelly-like mass, which is indigestible, and increases the size of the fecal masses, so that the intestines become distended.

The distention of the intestines produces frequent strong contractions of its muscle wall (peristalsis), which result in frequent movements of the bowels.

It is given in milk, and is eaten like oatmeal gruel or any other cereal.

Preparations

Agar Agar	4.0–15.0 gms.	ʒi–ʒ½

Regulin, is a preparation of agar agar with cascara, and is given in the same doses.

Agar Agar with Calumba
Agar Agar with Gentian
Agar Agar with Phenolphtalein
(Einhorn)

HORMONAL (Peristaltic Hormone, Zuelzer) (not official)

Hormonal is the extract in normal salt solution, of the spleen of an animal that is killed at the time when its digestive processes are most active; usually about an hour after being fed a heavy meal. The guinea pig's spleen is used in making the extract.

It is usually given by injecting the preparation directly into a vein (intravenously) or into the muscles (intramuscularly).

ACTION

About two to twenty-six hours after injecting hormonal, the patient begins to have frequent movements of the bowels. The stools are formed, and accompanied by little griping. After that, he has about one or two normal stools regularly, for a few days. Occasionally, there is a slight rise of temperature and pain at the spot of injection, which lasts for about twenty-four hours.

Mode of Action

Hormonal is a substance which is manufactured by the lining membrane of the stomach, at the time when digestion is greatest. This substance enters the blood stream, which carries it to the spleen and it is there stored up. The spleen then secretes this substance again into the blood stream, and it is then carried to the muscle wall of the intestines, increasing its contractions (peristalsis), which then cause movements of the bowels.

Preparations

Hormonal Intramuscular 20.0 c.c. ℥v

(A preparation of hormonal for intramuscular use. It usually comes in blue bottles.)

Hormonal Intravenous 20.0 c.c. ℥v

(A preparation for intravenous use. It usually comes in brown bottles.)

Uses

Hormonal is used in obstinate cases of constipation. It is also used in patients who have been operated upon, and who have difficulty in moving their bowels, or passing gas after the operation.

It is only given by intravenous or intramuscular injections.

No preparation of opium or morphine, should be given before or after hormonal, as it neutralizes its effect.

SALINE PURGATIVES

Saline purgatives are inorganic (mineral), salts used as purgatives. They are all combinations of alkalies with

acids. Only those salts are used, which are not absorbed in the doses given.

Action

Locally: The saline purgatives produce no effect.

In the mouth: Most of them have a harsh unpleasant bitter taste.

In the stomach: They often produce nausea and vomiting.

In the intestines: They produce frequent fluid stools accompanied with griping.

Mode of Action

When given in small doses, so that the percentage of salt in the intestine is **less** than that in the blood (anisotonic), or **equal to** that in the blood (isotonic), the salts are not absorbed, but they prevent the passage of fluids through the lining membrane of the stomach and intestines (absorption), so that the intestines, particularly the large intestine, fills up with fluid, and this produces contractions of its muscular wall, with resulting frequent fluid stools.

When given in larger doses so that the percentage of salt in the intestines is **greater** than that in the blood (hypertonic), the salts are not absorbed, but they withdraw fluid into the intestines, from the blood and tissues, until the percentage of salt in the intestines is reduced to the same percentage as that in the blood. Then part of the salt is absorbed, and the rest helps to fill up the large intestine, and distend it. This distention causes peristalsis of the intestines, which produces frequent watery stools.

The saline cathartics are particularly valuable in cases where there is a great deal of fluid in the tissues (oedema). For example—To reduce oedema of the legs in nephritis, or to reduce ascites (fluid in the abdomen).

They withdraw the fluid from the tissues into the intestines, and the frequent movements of the bowels which they then produce, gets rid of this excessive fluid, and in this manner the saline cathartics relieve the oedema or ascites.

They are also given to reduce the blood pressure, because

they withdraw fluid from the blood, and thereby lessen the amount of blood, as a result of which, the blood pressure is reduced.

The saline cathartics should not be given in cases where there are ulcers or inflammation in the intestines, as they aggravate this condition.

A small portion of each dose of the salines is absorbed, and acts on the kidneys as a diuretic, increasing the flow of urine.

Administration

The saline cathartics are best given well diluted, preferably in the morning, when the stomach is empty. They move the bowels in a few hours.

Preparations

Salts of Sodium

Sodium Sulphate (Glauber's Salt) 2.0–30. gms. ʒ½–ʒi
(Sodii Sulphas)

It is best given in solution, in vichy or seltzer, not stronger than 5–10%.

It is soluble in 3 parts of water.

Sodium Phosphate 1.0–30.0 gms. grs. xv–ʒi
(Sodii Phosphas)

This is best given in milk, not stronger than 5–10%.

It is soluble in 6 parts of water.

Salts of Potassium

Potassium Sulphate 1.0–4.0 gms. grs. xv–ʒi
(Potassii Sulphas)

Potassium Bitartarate (Cream of tartar)
(Potassii Bitartaras) 1.0–4.0 gms. grs. xv–ʒi

Potassium and Sodium Tartarate (Rochelle Salt)
(Potassii et Sodii Tartaras) 8.0–16.0 gm. ʒii–iv

It is soluble in 1½ parts of water.

It tastes pleasanter than Epsom salts.

These preparations are best given in cold seltzer or vichy.

If they are given hot, the addition of 10 or 15 drops of tincture of ginger makes them taste more agreeable.

They should not be given stronger than 5–10% solutions.

Salts of Magnesium

Magnesia Oxide or Calcined Magnesia, or light magnesia
(Magnesii Oxidum) 4.0 gms. ʒi

Heavy Magnesia
(Magnesia Oxidum Ponderosa) 4.0 gms. ʒi

Magnesia is very mild in action.

Magnesium Sulphate (Epsom salts)
(Magnesii Sulphas) 2.0–30.0 gms. ʒ½–ℨi

It is soluble in 1 ½ parts of water.

Magnesium sulphate is very commonly used. It has a very unpleasant taste and is best given in seltzer or vichy.

Large doses produce very rapid effects, with a good deal of griping.

Magnesium Carbonate 4.0–8.0 gms. ʒi–ii
(Magnesii Carbonas)

This preparation is not used very often.

The preparations of magnesia are best given in powder form, sweetened to disguise the taste.

Carlsbad Salt
(Sal Carolinum)

This is a mixture of the mineral salts obtained by evaporating the water of the carlsbad mineral spring in Bohemia.

Artificial Carlsbad Salt
(Sal Carolinum Factitium)

This is a mixture of the salts contained in natural carlsbad salts, and consists of

Dried Sodium Sulphate	44 parts
Potassium Sulphate	2 "
Sodium Chloride	18 "
Sodium Bicarbonate	36 "

Artificial carlsbad water contains about 70 parts of this salt to 1000 c. c. of water.

EFFERVESCENT PREPARATIONS

These preparations of the salts, produce gas (effervesce), when dissolved in water.

Seidlitz Powder
(Pulvis Effervescens Compositus)

This is made up in two powders,

1. One powder wrapped up in blue paper contains:

Sodium Bicarbonate	2.5 gms.	grs. xl
Rochelle Salts (Potassium and Sodium Tartarate)	8.0 gms.	ʒii

2. Another powder wrapped up in white paper contains:

Tartaric Acid	1.5 gm.	grs. xxv

The seidlitz powder should always be made up at the bedside. Each powder should be dissolved in half a glass of water, and then the two solutions should be mixed; and the mixture given to the patient.

The tartaric acid and sodium bicarbonate combine, and form carbon dioxide gas, which produces the effervescence. Seidlitz powder is often given to distend the stomach, for diagnostic purposes.

Solution of Citrate of Magnesia
(Liquor Magnesii Citratis) dose 150.0–360.0 c.c. ℥v–xii

This is a solution of magnesium citrate and citric acid, to which potassium bicarbonate is added. It is usually kept in tightly closed bottles, and effervesces when it is poured in a glass.

Effervescent Magnesium Sulphate 15.0–30.0 gms. ℥½–i
(Magnesii Sulphas Effervescens)

This contains epsom salts, sodium bicarbonate, tartaric and citric acids. The mixture effervesces when mixed with water.

Effervescent Sodium Phosphate 8.0–15.0 gms. ʒii–℥½
(Sodii Phosphas Effervescens)

This contains sodium phosphate, sodium bicarbonate, tartaric and citric acids. The mixture effervesces when dissolved in water.

Effervescent Lithium Citrate 4.0–8.0 gms. ʒi–ii
(Lithii Citras Effervescens)

This contains lithium, citrate, or carbonate, sodium bicarbonate and citric acid.

All these effervescent preparations, if not already in solution, should be given in a tumbler of water.

Many natural mineral waters are used as cathartics. The following are the most important ones:

Hunyadi Janos (non-official)

Carlsbad Water

This contains magnesium and sodium sulphate, and other salts.

Apenta Water (non-official)

This consists mainly of sodium and magnesium sulphate with small quantities of sodium chloride and bicarbonate of soda.

Pluto Water (non-official)

This is obtained from the French Lick springs in Indiana, and consists mainly of sodium and magnesium sulphates with small quantities of sodium chloride, calcium, magnesium and iron salts.

DRASTIC CATHARTICS

Drastic cathartics are drugs which produce frequent fluid movements of the bowels, accompanied by severe griping pains.

They cause very severe action, at times the stools may even be tinged with blood, and may contain flakes of mucous membrane.

When several drastic cathartics are given together, they are not so apt to cause violent action.

In large doses, most of the drastic cathartics are violent poisons.

The symptoms which such doses cause, are nausea, vomiting, abdominal pain and profuse diarrhoea. The stools contain blood and flakes of the lining membrane of the intestines, which is usually very severely inflamed by large doses of the drastic purgatives. In spots, the lining membrane may even be destroyed by such doses.

Associated with these symptoms, the patient is usually in severe collapse. The skin is pale, moist and cold, the breathing is slow and shallow, the pulse is rapid thready and weak, the pupils are widely dilated, and the patient finally goes into coma and dies.

JALAP—JALAPA

Jalap is the root of the **Ipomoea jalapa**, a twining vine of Mexico.

The active principles are two glucosides, **jalapin** and **convolvulin.**

ACTION

Local Action: on mucous membranes powdered jalap causes pain, redness and excessive secretion of mucus.

Internal Action

In the stomach, in ordinary doses, it increases the secretion of gastric juice.

Jalap acts principally on the intestines, increasing the secretions of its lining membrane and increasing the peristaltic contractions of its muscle wall. It also withdraws fluid from the blood and tissues, into the intestines.

The result of this action is to produce frequent large watery stools, accompanied by griping.

In addition to its drastic purgative action, it is used to relieve dropsy (fluid in the tissues), and ascites (fluid in the abdomen).

Jalap is rarely given alone. It is usually combined with some other purgative, particularly calomel.

Poisonous Effects

In overdoses, jalap causes severe abdominal pain, vomiting, profuse diarrhoea and the symptoms of collapse.

Preparations

Jalap (Jalapa)	0.3–1.0 gm.	grs. v –xv
Resin of Jalap (Resinae Jalapae)	0.1–0.3 gm.	grs. ii –v
Compound Jalap Powder (Pulvis Jalapae Compositus)	1.0–4.0 gms.	grs. xv–℥i

This contains jalap and cream of tartar.

SCAMMONY (SCAMMONIUM)

Scammony is the dried milky juice (resin), obtained from the root of the **Convolvulus scammonia,** a vine growing in Syria.

Its active principle is mostly **jalapin.**

ACTION

Scammony is used principally as a drastic purgative. It acts like jalap, producing frequent copious fluid stools accompanied by griping.

Scammony is frequently adulterated, and for this reason, the resin is the only preparation used, usually in combination with other purgatives.

Preparations

Resin of Scammony (Resina Scammoniae)	0.2–0.5 gm.	grs. iii–viii

COLOCYNTH (COLOCYNTHIS)

Colocynth is the pulp of the bitter cucumber or **Citrullus colocynthis** which grows on vines in Egypt, Syria, South Africa, Turkey and Japan.

Its active principle is a glucoside **colocynthin.**

ACTION

Local Action: On mucous membranes colocynth causes pain, redness with profuse secretion of mucus.

Internal Action

In the stomach: Colocynth increases the secretion of gastric juice and the peristalsis.

In the intestines: Colocynth acts principally on the intestines, greatly increasing the secretions of the intestinal mucous membrane, and producing violent peristalsis. It also draws fluid from the tissues and blood into the intestines.

The result of this action, is frequent movements of the bowels, with copious watery stools accompanied by griping.

Poisonous Effects

In large doses colocynth is an active poison, producing nausea, profuse vomiting, abdominal pain and very profuse diarrhoea. The stools contain blood and often flakes of the mucous membrane of the intestine.

These symptoms are associated with profound collapse.

The patient looks pale, the skin is cold and moist, the pulse is rapid, weak and thready, the breathing is slow and shallow and the pupils are widely dilated.

These symptoms gradually become worse until death finally results. Frequent cases of colocynth poisoning have occurred.

Colocynth is rarely given alone, but usually combined with other purgatives.

Preparations

Extract of Colocynth (Extractum Colocynthidis)	0.1–0.3 gm.	grs. ii–v
Compound extract of Colocynth (Extractum Colocynthidis Compositum)	0.2–1.0 gm.	grs. iii–xv

Containing colocynth, aloes, scammony and cardamon.

Colocynthin (active principle) (Not official)	0.005–0.01 gm.	grs. $\frac{1}{12}$ $\frac{1}{6}$

PODOPHYLLUM

Podophyllum is the underground root and rootlets of the **Podophyllum peltatum,** the May apple or mandrake, a perennial plant growing in Northern and Middle United States.

Its active principles are two glucosides, **podophylotoxin** and **picropodophylin.** It also contains an alkaloid berberine.

ACTION

Local Action: On the skin it causes redness.

On mucous membranes podophyllum causes pain, redness and profuse secretion of mucus.

Internal Action

In the mouth: It has a bitter pungent taste and increases the flow of saliva.

In the stomach: It increases the secretion of gastric juice and the peristalsis of the muscle wall of the stomach, often therefore causing nausea and vomiting.

In the intestines: Podophyllum acts principally on the duodenum or first part of the small intestine, increasing the secretions of its lining membrane, and markedly increasing the contractions of its muscle wall.

The peristalsis of this part of the intestine also causes contractions of the bile ducts (which are attached to this part of the intestine), so that more bile passes into the intestines.

Jalap therefore produces frequent copious fluid stools containing a great deal of bile, in about ten to fifteen hours after it is given.

Podophyllum will also act as a drastic purgative if given hypodermically, or if it is absorbed from mucous membranes or the broken skin. This is probably due to the fact that it is excreted by the lining membrane of the intestines.

Poisonous Effects

In large doses, podophyllum causes violent and even dangerous symptoms.

Abdominal pain, nausea, profuse vomiting and diarrhoea. The stools contain flakes of mucous membrane and blood.

Associated with these symptoms, the patient presents the usual picture of collapse: cold moist skin, rapid thready weak pulse, slow and shallow breathing, dilated pupils. Finally the patient goes into coma, may have epileptic convulsions and die.

Preparations

Fluidextract of Podophyllum (Fluidextractum Podophylli)	0.3 –1.0 c.c.	m. v–xv
Resin of Podophyllum (Resina Podophylli)	0.015–0.06 gm.	gr. $\frac{1}{4}$–i
Pills of Podophyllum Belladonna and Capsicum (Pilulae Podophylli Belladonnae et Capsici)		1 pill
Podophylin and Podophylotoxin (Unofficial)	0.005–0.01 gm.	gr. $\frac{1}{12}$–$\frac{1}{6}$

GAMBOGE (GAMBOGIA)

Gamboge is a gum resin obtained from the **Garcinia hanburii**, a tree of Siam. The leaves and young branches of the tree are broken off, and the juice is caught from the broken twigs in vessels and dried. This is the gum resin.

Gamboge is used principally as a drastic purgative.

It produces frequent large copious fluid stools accompanied by violent griping pains. Gamboge is one of the most violent

drastic purgatives, and is usually given in small doses with other purgatives.

Large doses of gamboge produce such violent catharsis and vomiting, with so much collapse, that death has occurred from these symptoms.

Preparations

Gamboge (Gambogia)	0.1–0.6 gm.	gr. ii–x

ELATERINE AND ELATERIUM

Elaterium is the juice obtained from the fruit of **Ecballium elaterium, or squirting cucumber,** of Greece and Western Asia. This fruit contains an inner sac which is filled with juice and contains the seeds. The dried juice is elaterium, from which is obtained **elaterin,** the active principle which is the preparation used. It is a neutral crystalline substance.

ACTION

Local Action: Elaterine is decidedly harmful to the **skin,** causing destruction of the superficial layers. In those who handle this drug, it often causes ulcers and inflammation of the fingers.

On mucous membranes it causes marked redness and swelling with profuse secretion of mucus.

Internal Action

In the stomach: Elaterine increases the secretion of the gastric juice and the contraction of the muscle wall, often causing nausea and vomiting.

The intestines are the principal organs affected by elaterine. It increases markedly the secretions of the lining membrane of the intestine and the peristalsis of its muscle wall. It also withdraws fluid from the blood and tissues into the intestines.

The effect of all this activity is to cause frequent copious watery stools, with comparatively little griping, though the very frequent movements are very exhausting to the patient.

Elaterine is one of the most effectual drastic purgatives.

It is often given hypodermically and probably produces its effect when given in this manner, by being excreted by the intestinal mucous membrane.

It is used very frequently to remove fluid from the tissues in cases of dropsy (fluid in the tissues) and in ascites (fluid in the abdomen), and to reduce the blood pressure, by lessening the amount of blood, in cases of apoplexy.

Poisonous Effects

In large doses, elaterine causes violent vomiting and profuse diarrhoea with bloody stools, associated with such very severe collapse, that it may cause death.

Preparations

Elaterine (Elaterinum)	0.001–0.005 gm.	gr. $\frac{1}{60}$–$\frac{1}{10}$
Triturate of Elaterine (Trituratio Elaterini)	0.015–0.06 gm.	gr. $\frac{1}{4}$–i

Containing 1 part of elaterine, to 9 parts of sugar of milk.

COMPOUND PREPARATIONS OF DRASTIC PURGATIVES

Compound Cathartic Pills
(Pilulae Catharticae Compositae)

This is very frequently used. Each pill consists of:

Compound Extract of Colocynth	0.08 gm.	gr. $1\frac{1}{3}$
Calomel	0.06 gm.	gr. i
Resin of Jalap	0.2 gm.	gr. $\frac{1}{3}$
Gamboge	0.015 gm.	gr. $\frac{1}{4}$

1 pill is given as a purgative, 3 pills as a drastic.

Vegetable Cathartic Pills
(Pilulae Cartharticae Vegetabiles)

Compound Extract of Colocynth	0.06 gm.	gr. i
Extract of Hyoscyamus	0.03 gm.	gr. $\frac{1}{2}$
Resin of Jalap	0.02 gm.	gr. $\frac{1}{3}$
Extract of Leptandra	0.015 gm.	gr. $\frac{1}{4}$
Resin of Podophyllum	0.015 gm.	gr. $\frac{1}{4}$

and about m. i of oil of peppermint for every hundred pills.

The peppermint and the hyoscyamus (which contains an active principle atropine) lessen the griping.

CROTON OIL (OLEUM TIGLII)

Croton oil is a fixed oil (an oil which does not evaporate) pressed out from the seeds of the **Croton tiglium,** a shrub growing in Hindostan and other parts of Southern Asia.

Its active principle is an acid **crotonoleic acid.**

ACTION

Local Action: On the skin croton oil causes redness with small elevated spots (papules). These soon form blisters which easily become infected and form pustules.

Internal Action

In the mouth it has a hot burning taste.

In the stomach it often causes nausea, vomiting and pain in the abdomen.

In the intestines: Croton oil acts principally on the intestines; producing in one or two hours after it is given, frequent large fluid stools with severe griping pains.

The violent movements of the bowels continue for about twelve to fifteen hours, and each stool is accompanied by severe griping, so that the patient soon becomes exhausted.

Mode of Action

Croton oil acts in the same manner as castor oil does. Crotonoleic acid is formed by the digestive juices, and this causes the purgative action.

Some of the crotonoleic acid is then absorbed into the blood, and is excreted by all the secretions.

Poisonous Effects

In large doses, croton oil causes severe abdominal pain, nausea, vomiting, and profuse diarrhoea. The stools contain flakes of mucous membrane and blood.

These symptoms are accompanied by very profound

collapse: pale cold moist skin, slow and shallow breathing, rapid, weak thready pulse, and dilated pupils. The symptoms may become so severe as to cause death.

Preparations

Croton Oil (Oleum Tiglii)	0.06–0.12 c.c.	m. i–ii

Administration

Croton oil is given principally in cases where the patient is unable, or unwilling to swallow. In cases of apoplexy for instance, when the patient is unconscious; or in an attack of mania, when the patient is so excited, that he is unwilling to swallow medicine.

In such cases one or two drops, either of the pure croton oil, or the oil dissolved in glycerin or olive oil, are given to the patient. It is also often given on a piece of sugar, or on a few bread crumbs.

Croton oil is occasionally applied to the skin, to produce redness, and thereby relieve congestion of deeper organs, (counter irritant). A few drops of croton oil are poured on a piece of flannel, which is then rubbed on the skin. It may also be added to olive oil, or to a liniment, which is then rubbed on the skin.

ENEMATA

Enemata are fluids which are injected into the rectum. There are two kinds of enemata; **cathartic** and **nutritive.**

Cathartic Enemata

Cathartic enemata are given to move the bowels. They usually act by distending the large intestine, so that peristalsis is set up, and the contents of the intestines are expelled and frequent movement of the bowels result.

The substances which are commonly used in enemata are:

Plain Water
Salt Solution
Soap Suds
and various Cathartics.

An excellent combination of cathartics which is given as an enema consists of ox gall, magnesium sulphate, turpentine and water. The turpentine is particularly valuable because it helps to expel gas. Another very excellent combination is one consisting of milk and molasses; or an enema containing starch. These substances are especially efficient, because the sugar or starch which they contain forms gas which distends the intestine very much, causing frequent copious movements of the bowels.

Method of Administration

An enema should be given by means of a fountain syringe, the patient lying on the back. The rubber nozzle is inserted into the rectum, the bag is held about three feet above the level of the patient, and the fluid is allowed to run into the rectum very slowly.

In many cases, the enema is more effectual if the patient is placed in the knee chest position.

Nutritive Enemata

Nutritive enemata are usually given to nourish the patient, when food cannot be taken by the mouth. They usually consist of milk, eggs, various meat juices, broths, or special prepared substances. They should preferably be peptonized.

Administration

Nutritive enemata should be given very slowly, best by the rectoclysis, or **Murphy Method.**

PART II—STIMULANTS ACTING AFTER ABSORPTION

CHAPTER VIII

BLOOD AND CIRCULATORY STIMULANTS

THE BLOOD

The blood is a thick red fluid, which supplies all the various tissues and organs of the body with nourishment and oxygen. It also takes away all their waste products, resulting from the various activities of these tissues and organs. These waste products are then brought to the lungs, kidneys and intestines where they are excreted.

The blood consists of a straw colored fluid (plasma) in which float small round cells called corpuscles.

There are two kinds of corpuscles: red corpuscles and white corpuscles, or leucocytes.

The red corpuscles contain a substance haemoglobin, which contains iron, and gives these corpuscles their red color.

The haemoglobin of the red corpuscles takes up oxygen from the air in the lungs; and brings it to the various organs of the body where it is used up by the various activities of these organs.

The white corpuscles, together with the plasma, also act as cleansers of the blood. They destroy all bacteria in the blood and neutralize their poisons by the antidotes which they form. The white corpuscles then bring these dead bacteria to the kidneys, intestines and other organs for excretion. These organs, by their secretions, get rid of the bacteria.

Formation of Blood

The plasma is formed from the digested food; which then passes through the lining membrane of the intestines into

the blood vessels. Some of the digested food first enters the lymphatic vessels, and then into the blood.

The red and white corpuscles of the blood are formed in the bone marrow and the spleen.

The haemoglobin is formed in the liver and spleen.

Drugs affect the blood in two ways:

1. By **increasing the amount, or improving the quality.**

Stimulation

This can be done in several ways:

a. They may *increase the amount* of plasma and the number of red or white corpuscles, or both.

b. They may *improve the quality* of the corpuscles, for example, by increasing the amount of haemoglobin.

2. They may **lessen the amount, or deteriorate the quality** of the corpuscles and plasma.

Depression

This effect is produced in several ways:

a. They may *lessen the amount* of blood by taking away some of the fluids.

b. They may reduce *the number of corpuscles.*

c. They may *combine with the haemoglobin* so that it is unable to take up oxygen from the air in the lungs.

We shall here consider only those substances which improve the condition of the blood (blood stimulants).

HAEMATINICS (BLOOD STIMULANTS)

These drugs are often called tonics.

NORMAL SALT SOLUTION

In cases where a patient has lost a considerable amount of blood, life may be endangered, because there is not a sufficient amount of blood for the heart to pump. The heart beats then become very weak and slow, and the pulse is weak, slow and soft.

To keep the heart beating, until new blood can be formed, to make up for the amount that has been lost, we often

inject into a vein, or into the muscles, salt solution of a definite percentage, to keep the heart beating; and thereby keep up the circulation of the blood.

The percentage of salt (sodium chloride) used, is a 0.9% solution or 9 parts of salt to a thousand of water. Such a solution is called a **normal salt solution.**

This strength of salt solution is used, because it does not destroy the red corpuscles of the blood. If a fluid weaker than this percentage is injected into the blood, the red corpuscles are destroyed. If a stronger percentage of salt solution than 0.9% is used, the blood corpuscles are shrunk (crenated).

There are various strengths usually given for normal solution, varying from 0.6% to 0.9%. It is also often called **physiological salt solution.**

The differences in the strengths are due to the fact that the blood contains other salts besides sodium chloride, such as calcium and magnesium sulphates and phosphates.

The amount of sodium chloride in the blood is about 0.6%, while the percentage of all the salts in the blood amounts to about 0.9%.

A salt solution containing the exact percentages of all the salts in the blood is often used in laboratories. This is called **Ringer's solution.**

For practical purposes, however, normal salt solution contains 0.9% of sodium chloride, which is the percentage of all the salts in the blood.

Such a salt solution is obtained by adding ʒii (8.0 gms.) of pure sodium chloride to a quart of sterile water.

In making a normal salt solution, it is very important to use only absolutely sterile water; and pure sodium chloride.

Methods of Administration

1. **Intravenous Infusion:** This is the quickest method for getting normal salt solution into blood.

The solution is injected into the median basilic, or median cephalic veins of the forearm, by means of a special apparatus.

The apparatus is held about two feet above the patient, and the salt solution is allowed to run through a long rubber tube and cannula; the cannula being inserted into the vein towards the heart.

2. **Hypodermoclysis:** This is a slower method of getting normal salt solution into the blood.

The solution is allowed to run in underneath the breasts, or into the thighs, through a large needle which is inserted in these regions, and which is attached to a rubber tube extending to a receptacle which contains the salt solution. The fluid is then absorbed into the blood from the tissues underneath the breasts, or from the thighs.

3. **Rectoclysis,** or *Murphy Method*: A recent method of getting normal salt solution into the blood, is by allowing the solution to run into the rectum, drop by drop, through a catheter attached by a long rubber tube, to a receptacle containing salt solution, which is held a few feet above the level of the bed. The solution is then absorbed into the bood through the lining membrane of the rectum.

Normal Salt Solution Should Always be Given Warm

Effects

After an intravenous infusion, or a hypodermoclysis of salt solution, the heart usually beats stronger and faster, the pulse is stronger, faster and more bounding in quality; and the blood pressure is very much increased. The patient breathes faster and deeper and feels brighter.

Transfusion

Occasionally when the patient has lost a great deal of blood; blood from another individual is allowed to run into the veins of the patient. This is done by sewing an artery of the healthy individual to the vein of the patient; and allowing the blood from the healthy individual to run into the patient, for about an hour. The effects produced are the same as when giving an infusion, but they are more lasting.

IRON (FERRUM)

Iron is a heavy metal; many of its preparations are used as drugs. Many food substances, such as meat, eggs and some vegetables, contain a great deal of iron.

In the body, iron is found principally in the haemoglobin of the blood; about one part of iron to 230 parts of corpuscles.

ACTION

Local Action: On the skin iron causes no change, but if it is applied to a bleeding surface, it stops the bleeding, by precipitating (hardening) the albumins of the blood, which then close up the bleeding vessel. **Mucous membranes** are contracted by preparations of iron (astringent action).

Internal Action

In the mouth: Iron has a distinct metallic taste, and shrinks the lining membrane of the mouth, making it feel dry. It also blackens the teeth, if used continually.

In the stomach: It also contracts the lining membrane and occasionally causes nausea.

In the intestine: Iron contracts the lining membrane, checking the secretions, thereby producing constipation.

Action after Absorption

Part of the iron taken in as food, or as a medicine is slowly absorbed from the duodenum, or first part of the small intestine. It is then carried to the spleen, where it is stored up for future use; and to the liver, where it **helps to form haemoglobin** for the red blood corpuscles. If iron is taken for any length of time, more haemoglobin is therefore formed; and the red blood corpuscles contain more haemoglobin. They are then better able to take up more oxygen from the air in the lungs. The corpuscles then supply the various organs and tissues of the body with more oxygen; so that these organs are able to do their work better. The corpuscles too, are also better able to take away more waste products.

As a result of these effects, the heart beats stronger and

faster; because its muscles are supplied with more oxygen. The patient is able to breathe deeper, and take in more air (and therefore more oxygen) because the muscles for breathing, such as the diaphragm, are supplied with more oxygen. The breathing center in the brain, also sends more impulses for breathing; because it too, is supplied with better nourishment. The food is digested better; because the stomach, the salivary and pancreatic glands secrete more digestive juices, as a result of being supplied with more nourishment and more oxygen.

The muscles act better, because they, too, are supplied with better blood, containing more oxygen.

The brain is more active, the patient is brighter, is more in harmony with his surroundings, because the brain is supplied with blood containing more oxygen.

All the organs of excretion, such as the kidneys, the lungs and skin, get rid of waste products better and quicker, because these organs are supplied with better blood and are able to do their work better.

Appearance of the Patient

As a result of the improved activity of all the organs of the body, the patient feels brighter, is more active, more robust, he looks better, has a better color, his appetite is better, and he digests his food better.

These effects do not come on after a few doses, but result from continued administration of iron.

A drug which improves the general condition of the patient in this manner, is called a **tonic.**

Excretion

Only part of the iron taken as a medicine, or in the food, is absorbed. The rest is excreted by the intestines, in the stools. On account of the large amount of iron which is present in the stools, the lining membrane of the intestines is contracted, and constipation results.

Uses

Iron is used principally in cases of **anaemia**; a condition where the patient's blood is very poor; for example—when

the patient has lost a great deal of blood, or when he is suffering from some chronic disease, such as tuberculosis or cancer. It is also used with best results in a peculiar kind of anaemia, occurring in young girls, called **chlorosis.**

Poisonous Effects

In some cases, after continued use of iron for any length of time, it produces the following symptoms. Frontal headache, loss of appetite, pain in the pit of the stomach, occasionally nausea and vomiting, colic and invariably constipation. Sometimes the skin becomes covered with very small pustules (acne).

The condition is relieved by stopping the iron, and giving cathartics.

Administration

In giving iron, the nurse should carry out the following rules:

1. Iron should always be given well diluted, after meals.
2. To avoid blackening the teeth, it should always be given through a glass tube, so that it does not touch the teeth.
3. To avoid constipation, whenever iron is given, the bowels should be moved regularly with some cathartic, or a preparation of iron should be given which contains a cathartic.
4. If a gargle containing iron is used, the teeth should be brushed after each application, and the mouth then gargled with salt water.
5. Silver spoons are stained by iron and they should never be used in giving iron. Strong ammonia water removes these stains.
6. Iron also stains clothing, sheets, carpets, etc. Oxalic acid removes these stains.

Preparations

The preparations of iron are very numerous and only the most important ones are here given.

There are several preparations of iron which are only used for their local effects or to check bleeding.

For internal use there are two kinds of preparations.

Inorganic and Organic

The **inorganic** preparations are metallic salts of iron.

The **organic** preparations are preparations of iron combined with various kinds of proteids, such as egg albumin for instance.

The organic preparations do not contract mucous membranes as much as the inorganic ones, and are therefore not so apt to cause unpleasant symptoms.

Preparations for Local Use

Solution of Iron Subsulphate 0.2–0.6 c.c. m. ii–x
(Liquor Ferri Subsulphatis)
(Monsell's solution)

This preparation contains about 13% of iron.

Iron Chloride
(Ferri Chloridum)

This preparation is used either in a 20% solution, or the pure crystals are allowed to take up moisture from the air by being exposed (deliquescent action), and are then used.

These two preparations are principally used locally, to stop bleeding or to contract mucous membranes, either by a local application, or given as a gargle.

Iron Sulphate 0.03–0.3 gm. grs. ½–v
(Ferri Sulphas)
(Green vitriol)

This is seldom used internally, but it is used to contract mucous membranes and check bleeding. It is also used as a disinfectant for privies or drains.

Preparations for Internal Use

Inorganic Preparations

Solid Preparations:
Pills of Iron Carbonate 1–5 pills
(Pilulae Ferri Carbonatis)
(Blaud's pills)

These pills consist of iron sulphate, the carbonate of sodium or potassium, tragacanth, sugar and glycerin.

Each pill contains about 0.06 gm. (gr. i) of iron.

These pills must be made up fresh, as otherwise they pass through the intestines without causing any effects, or without being themselves changed in any way.

Reduced Iron 0.06–0.12 gm. grs. i–ii
(Ferri Reductum)
(Quevenne's Iron)

This is a brown powder which is tasteless and does not contract mucous membranes. It is often given to children in candy.

Soluble Iron Phosphate 0.06–0.3 gm. grs. i–v
(Ferri Phosphas Solubilis)

Iron Citrate 0.06–0.3 gm. grs. i–v
(Ferri Citras)

Pills of Iron Iodide 1–3 pills
(Pilulae Ferri Iodidi)

Each pill contains 0.03 gm. (**gr.** ½) of reduced iron, also iodine, acacia, licorice and balsam of tolu.

Iron and Strychnine Citrate 0.1–0.3 gm. grs. ii–v
(Ferri et Strychninae Citras)

Contains 1% of strychnine and 16% of iron.

Iron and Quinine Citrate 0.3–0.6 gm. grs. v–x
(Ferri et Quininae Citras)

Contains 12% of quinine and 15% of iron.

Solid Preparations Combined with Cathartics

Iron and Potassium Tartarate 0.3–0.6 gm. grs. v–x
(Ferri et Potassii Tartaras)

Contains 15% of iron.

Pills of Aloes and Iron 0.2–0.5 gm. grs. iii–viii
(Pilulae Aloes et Ferri)

It contains dried iron sulphate and aloes. The aloes overcomes the constipating effect. It is often used in

cases of scanty menstruation or absence of menstruation (amenorrhoea), in chlorosis.

Fluid Preparations

Solution of Iron Tersulphate
(Liquor Ferri Tersulphatis)

Contains 10% of iron.

This preparation is only used to make other preparations, especially the antidote for arsenic.

Tincture of Iron Chloride 0.3–2.0 c.c. m. v–xxx
(Tinctura Ferri Chloridi)
(Muriated tincture of iron)

This is one of the best preparations of iron, and is very frequently used. It contains about 4% of iron in alcohol.

It is best given in milk or in glycerin, 3 parts of the preparation to one of glycerin, (to prevent constipation) or in egg albumin, to prevent its blackening the teeth.

Solution of Iron and Ammonium
Acetate 15.0–30.0 c.c. ʒ½–i
(Liquor Ferri et Ammonii Acetatis)
(Basham's mixture)

This preparation contains very little iron and must be freshly made. It consists of the tincture of iron chloride, dilute acetic acid, solution of ammonium acetate, elixir of orange, glycerin and water.

Syrup of Iodide of Iron 0.3–2.0 c.c. m. v–xxx
(Syrupus Ferri Iodidi) well diluted

This is an excellent preparation especially for children. It contains about 2% of iron.

Compound Iron Mixture 15.0–30.0 c.c. ʒ½–i
(Mistura Ferri Composita)
(Griffith's mixture)

This preparation contains iron sulphate, potassium carbonate, myrrh, sugar and spirits of lavender.

Elixir of Iron Quinine and Strychnine Phosphate
(Elixir Ferri, Quininae, et Strychninae Phosphatum)

This preparation is very frequently used as a tonic. It contains about 2% of iron phosphate.

Each teaspoonful dose contains ½ grain of iron phosphate and quinine and $\frac{1}{64}$ grain of strychnine.

Syrup of Iron, Quinine and Strychnine Phosphate
(Syrupus Ferri Quininae et Strychninae Phosphatum)
4.0–8.0 c.c. ʒi–ii

This preparation contains 9% of iron phosphate. Each teaspoonful dose, contains grs. v of iron phosphate, ⅛ grain strychnine and 1½ grain of quinine.

Antidotes for Arsenic

Iron Hydroxide
(Ferri Hydroxidum)

This preparation is used principally as an antidote for arsenic poisoning. About 8 grains of it will neutralize 1 grain of arsenic. It must always be fresh.

If it is not on hand, it can be made from the tincture of iron chloride, by adding ammonia water or sodium carbonate to it. A precipitate (sediment) will then form.

Enough ammonia or sodium carbonate must be added until no more sediment forms.

The sediment is then washed and strained, and given in milk, as often as is necessary to neutralize the arsenic.

Iron Hydroxide with Magnesia Oxide 15.0–30.0 gms. 1½–iʒ
(Ferri Hydroxidum cum Magnesii Oxido)

This is made from iron sulphate, to which is added magnesia. It is the best antidote for arsenic poisoning.

Dialyzed Iron (not official) 1.3–2.6 c.c. m. xx–xl
(Ferri Dialysatum)

This is a preparation of iron which is frequently used as an antidote for arsenic poisoning. It is also used in the treatment of anaemia.

ORGANIC PREPARATIONS

These preparations of iron are made with organic substances such as proteids; (albumins, peptones, etc.). They have no advantage over the other preparations of iron, except that they are more readily absorbed, and do not contract mucous membranes as much as the inorganic preparations. Most of them are not official.

Solid Preparations

Iron Tropon (not official) 4.0–8.0 gms. ʒi–ii

This is a preparation of iron with proteids, flavored with chocolate. It comes in powder form or in tablets. The powder is given in milk.

Haemogallol (not official) 0.25–0.5 gm. grs. iv–viii

This is an organic iron preparation made from blood.

Ferratin (not official) 0.5 gm. grs. vii½

This substance is made from egg albumin and iron.

Ferrous Lactate 0.06–1.2 gm. grs. i–xx
(Not official)

It is best given in syrup.

Fluid Preparations

Ferro Mangan 4.0–16.0 c.c. ʒi–ʒ½
(Not official)

This is a solution of iron, manganese and peptones. There are several other similar preparations under various names, such as peptomanganate of iron, etc.

Ovoferrin 8.0–16.0 c.c. ʒii–iv
(Not official)

This is a preparation made from serum albumin and iron by an electrical process.

Haemaboloids 15.0 c.c. ʒ½
(Not official)

This is a compound of iron, proteids and bone marrow.

Incompatibilities

The following drugs cannot be given together with iron as they form chemical compounds with it.

The preparations of iron should never be given with tea, or vegetable drugs containing tannin or tannic acid, as iron combines with these drugs and forms ink.

The alkaline preparations of iron should not be given with acids. For example—do not give Basham's mixture together with dilute acids, as they combine and form a sediment. The iron salts of the mineral acids should not be given with alkalies. For example—do not give tincture of iron chloride with sodium bicarbonate, as they will combine and form a sediment.

The most efficient and most frequently used preparations of iron are

Blaud's Pills
Tincture of Iron Chloride
Syrup of Iodide of Iron
Basham's Mixture

and a number of the organic preparations.

MANGANESE (MANGANUM)

Manganese is a metal. Many of its preparations are occasionally used in medicine.

It is found in the body in the red blood corpuscles, the hair and bile, usually together with iron.

Some of its preparations, especially potassium permanganate, is used as an antiseptic.

ACTION

Local Action: On the skin and mucous membranes, manganese contracts the tissues (astringent action).

Internal Action

In the mouth it contracts the mucous membranes.

In the stomach it increases the secretion of gastric juice, aids digestion and increases the appetite.

In the intestines it contracts the mucous membrane.

Action after Absorption

Manganese is partly absorbed in the intestine, and after absorption, it is said to act like iron, increasing the nutrition of the various organs and tissues of the body.

It is occasionally used as a substitute for iron. It cannot replace it, however, as it does not help to form haemoglobin.

It is said to increase menstruation.

It is excreted by the intestine and kidneys.

Poisonous Effects

Large doses of manganese cause nausea, vomiting and profuse diarrhoea, slow and very soft pulse with very low blood pressure, slow breathing and stupor.

If large doses of manganese are given for some time, it causes weakness, weak pulse, staggering gait and paralysis.

Preparations

Precipitated Manganese Dioxide (Mangani Dioxidum Praecipitatum)	0.25 gm.	grs. iv
Manganese Sulphate (Mangani Sulphas)	0.1–0.5 gm.	grs. ii–viii
Manganese Hypophosphate (Mangani Hypophosphis)	0.2 gm.	grs. iii
Potassium Permanganate (Potassii Permanganas)	0.03–0.15 gm.	gr. $\frac{1}{2}$–iii

This preparation gives off oxygen, and for this purpose, it is often given in cases of poisoning from various drugs. For example—in morphine poisoning it is given to neutralize the morphine by the oxygen which the potassium permanganate liberates, which then combines with the drug.

It is also used as an antiseptic, acting in a similar manner, the oxygen destroying the bacteria.

There are a number of unofficial preparations of iron which are combined with manganese.

ARSENIC

Arsenic is a metal which is commonly used in the manufacture of dyes and other commercial products.

It is one of the oldest drugs in medicine, and was very frequently used during mediaeval times for criminal poisoning. There are a number of compounds of arsenic, but only one group of them is used in medicine. These are the compounds of arsenic trioxide, white arsenic or arsenious acid.

Appearance of the Patient

When small doses of arsenic are given for some time, the patient feels better, stronger and is more active. He looks more robust, somewhat stouter and has a better color. The appetite is better and the bowels move more often. The pulse is stronger, somewhat faster and the patient breathes somewhat deeper. In short, the patient feels better and stronger.

ACTION

Local Action: Arsenic applied to the skin causes inflammation and pain. If it is allowed to remain on the skin for a longer time, the skin is destroyed and an ulcer remains. (Escharotic action.) Arsenic is slightly antiseptic.

It is easily absorbed from the injured skin. **On mucous membranes** when applied locally, it also causes redness and pain, with subsequent inflammation and destruction of the tissues.

Internal Action

In the mouth arsenic has a sweetish taste, causes redness of the lining membrane of the mouth and increases the flow of saliva.

Arsenic affects principally the stomach and intestines

In the stomach it causes a sense of heat, it increases the appetite and the secretion of gastric juice.

In the intestines it also increases the secretion of the

mucous membrane of the intestines, and it also increases the peristalsis, so that the bowels move more actively and more often.

Action after Absorption

Arsenic is rapidly absorbed from the stomach and intestines, as well as from all the mucous membranes. After absorption, it affects principally the blood and the tissues.

Action on the Blood: Arsenic increases the number of red blood corpuscles. It increases the formation of these corpuscles in the bone marrow.

Since there are more red blood corpuscles in the blood, they are able to carry more nourishment and more oxygen to the organs and tissues of the body, and remove more waste products.

In this way, they increase the activity of all the organs of the body in the same way as iron does.

The patient is then healthier, more robust, has a better appetite and feels better (tonic action).

Action on the Tissues: Arsenic prevents the tissues from being used up (lessens oxidation). It therefore increases the growth and nutrition of the tissues and organs of the body. As a result of this action, if arsenic is taken for some time, the patient usually becomes somewhat stouter.

Action on the Circulation: In the doses that arsenic is usually given, it makes the heart beat stronger, though the rate of the pulse is not much affected. The pulse is therefore usually much stronger.

Action on the Respiration: The breathing is usually deeper and faster, the patient takes in more air, and therefore more oxygen for the greater number of corpuscles which the blood contains.

Action on the Brain and Spinal Cord: The brain and spinal cord are more active, when arsenic is given for some time. The effects of this increased activity, are shown by the following condition of the patient.

He is more active, brighter, he sees and hears better. He responds quicker and better to sensations (increased reflex action).

Excretion

Arsenic is excreted mainly by the urine, also by the lining membrane of the stomach, intestines and bronchi.

It is excreted very slowly and may therefore cause cumulalative symptoms.

Tolerance

When arsenic is taken regularly in small quantities, the patients are then able to take comparatively large quantities of the drug without getting poisonous effects. A patient is then said to have a **tolerance** for arsenic.

In some countries, for example in the Tyrol, the peasants eat large quantities of arsenic, because it enables them to do their work better, and to climb the mountains with less effort. It also improves their complexion. These peasants often live to a very old age.

Women very often take arsenic for a long time to improve their complexion and their figure. Some of them often get poisonous symptoms as a result of it.

Uses

Arsenic is used principally in **anaemia,** to improve the condition of the blood. It is often given together with iron.

It is also given for chorea (St. Vitus' dance), and as a tonic, to improve the general condition of the patient. Some of the newer preparations of arsenic are given as a specific for syphilis.

Poisonous Effects

There are two forms of arsenic poisoning.

1. Acute arsenic poisoning.
2. Chronic arsenic poisoning.

Acute Arsenic Poisoning

This follows a single large dose of arsenic taken with suicidal intent or by mistake.

Many rat and insect poisons, contain large quantities of arsenic.

There are **two forms** of acute arsenic poisoning.

a. Cases where the symptoms of the stomach and intestines are most marked. These cases are the most common and this form of poisoning is called **the gastero intestinal form.**

b. Cases where the nervous symptoms are most marked. These cases are called **the nervous form.**

Gastero Intestinal Form

About one-quarter of an hour to an hour after an overdose of arsenic is taken, the patient complains of **severe pains in the oesophagus and stomach,** and of a metallic taste in the mouth. The pains spread all over the abdomen and are accompanied by **profuse vomiting and diarrhoea.** The vomited matter contains bile, later serum and even blood, with small flakes of the lining membrane of the stomach floating about in the fluid. The stools are very fluid and contain many flakes of mucous membrane and blood.

As a result of the excessive vomiting and diarrhoea, the **patient is very thirsty, passes very little urine,** and whatever urine is passed contains blood and is passed with severe pain.

The collapse following these symptoms is very severe, the patient looks very pale, his skin is cold and covered with perspiration, later he looks very blue. The breathing is rapid, difficult and painful, because of the severe abdominal pain. The pulse is rapid, intermittent and weak. The pupils are widely dilated.

Finally the patient goes into **coma,** may have **convulsions** and die in from five to twenty-four hours. If the dose has not been very large, the patient may live longer, even for a few days or weeks and then die of exhaustion or nervous complications. During these symptoms the patient is conscious to the very last.

Nervous Form

In some cases the patient has little or no symptoms from the stomach and intestines (abdominal pain, vomiting diarrhoea, etc.); but instead, he goes into coma, has all the symptoms of collapse, has several convulsions and dies.

If the patient recovers from the acute symptoms, there may remain various nervous symptoms, such as, **areas of numbness on the extremities,** loss of sensation to heat and cold, and **paralysis of the extremities,** resulting in "drop hands" and "drop feet." The patient usually recovers from these symptoms however.

The smallest fatal dose of arsenic is 0.12 gm. (grs. ii).

Treatment of Arsenic Poisoning

In treating arsenic poisoning the following points must be considered.

1. The arsenic should be neutralized by giving an antidote.

The best antidotes for arsenic, are

Iron Hydroxide.

Iron Hydroxide with magnesia oxide.

These should be given until no more symptoms of arsenic occur.

2. **Produce vomiting,** by giving an emetic, such as mustard water, salt water, zinc sulphate or copper sulphate, or better still, wash out the stomach.

3. **Protect the lining membrane of the stomach and intestines;** by giving plenty of drinks of substances which protect the mucous membrane, such as albumin water, flaxseed water, gelatine, etc.

4. **Give plenty of water,** to increase the flow of urine, and thereby get rid of most of the arsenic, and to allay the thirst. Give cathartics to remove the poisons from the bowels.

5. The severe collapse, which may cause the death of the patient, should be treated by:

a. Hot applications to the skin, and plenty of coverings to keep the patient warm.

b. **Drugs to increase the heart action and the breathing.** The best ones are:

Caffeine

Atropine

Strychnine

Digitalis preparations (those that are rapidly absorbed).

Chronic Arsenic Poisoning

Chronic arsenic poisoning is very common. It occurs after giving arsenic preparations for some time; and since arsenic is excreted much slower than it is absorbed, cumulative symptoms, or chronic arsenic poisoning results.

It also results from inhaling fumes of arsenic, in rooms papered with wall paper containing arsenic dyes, by wearing clothing dyed with arsenic, or by eating food colored with arsenic dyes. The following symptoms in the order of their onset are noticed after prolonged administration. Often the later symptoms appear before the earlier ones.

Symptoms

1. Itching of the eyelids.
2. Redness of the conjunctiva of the eye.
3. Puffiness about the eyes, especially in the morning.
4. Sneezing, "running nose" (coryza).
5. Tightness in the throat.
6. Hoarseness.
7. Loss of appetite, heaviness in the stomach, nausea and vomiting.
8. Skin eruptions; red spots, areas of brownish discoloration (very often they look like freckles) on the face or the abdomen. Dark discolorations which look like pencil marks on the skin of the abdomen.

In severe cases, the hair and nails may fall off.

9. Cramp-like abdominal pains.
10. Diarrhoea with "rice water" stools. These are fluid stools which contain small flakes of the lining membrane of the intestine.

The following symptoms appear later and only in severe cases:

11. Persistent headache.
12. Pains around the knee, ankle, foot and hands.
13. Redness and swelling of the hands and feet.
14. Areas of skin which are very sensitive to touch, to pain, to heat and cold. These occur especially on the extremities.
15. In severe cases there are paralyses of the extensor

muscles of the hands and feet, resulting in "drop feet" and "drop hands."

Treatment of Chronic Arsenic Poisoning

If the arsenic is stopped and cathartics given, the symptoms usually disappear gradually. The paralyses must be treated by massage and electricity, until the muscles recover; which they usually do.

Preparations

Fluid Preparations:

Solution of Potassium Arsenite 0.06–0.5 c.c. m. i–viii
(Liquor Potassii Arsenitis)
(Fowler's solution)

This contains 1% of arsenic trioxide, potassium bicarbonate and tincture of lavender.

Five minims of Fowler's solution contain $\frac{1}{64}$ gr. of arsenic trioxide.

Solution of Sodium Arsenite 0.06–0.5 c.c. m. i–viii
(Liquor Sodii Arsenitis)
(Pearson's solution)

Solution of Arsenious Acid 0.06–0.5 c.c. m. i–viii
(Liquor Acidi Arsenosi)

This contains 1% of arsenic trioxide and dilute hydrochloric acid.

Solution of Arsenious and Mercuric Iodides 0.3–1.2 c.c. m. v–xx
(Liquor Arseni et Hydrargyri Iodidi)
(Donovan's solution)

This is the strongest preparation of all. It contains 1% each of arsenic iodide, and of red mercuric iodide. It may cause symptoms of mercury poisoning.

Solid Preparations:

Arsenic Trioxide 0.001–0.005 gm. gr. $\frac{1}{60}$–$\frac{1}{12}$
(Arsenii Trioxidum)

Sodium Arsenate 0.001–0.005 gm. gr. $\frac{1}{60}$–$\frac{1}{12}$
(Sodii Arsenas)

Arsenic Iodide (Arsenii Iodidum)	0.003–0.01 gm.	gr. $\frac{1}{20}$–$\frac{1}{6}$
Sodium Cacodylate (Sodii Cacodylas)	0.015–0.06 gm.	gr. $\frac{1}{4}$–i

This is a compound of cacodylic acid, which is a compound of arsenic. It is given hypodermically and is said to cause no unpleasant symptoms.

Arsen Triferrin (unofficial)	0.3 gm.	grs. v

This a compound of iron, arsenic, phosphorus and albumin.

Soamin (not official)

This is sodium arsanilate, and contains 22% of arsenic. It usually comes in tablets each containing 0.06 and 0.3 gm. (grs. i–v) of soamin.

Salvarsan " 606 "	0.3–0.6 gm.	grs. v–x
Neosalvarsan " 914 "	0.3–0.6 gm.	grs. v–x

These are organic compounds of arsenic which are used as specifics for syphilis. They are given intravenously, like an intravenous infusion, or they are injected deep into the muscles. Salvarsan has to be neutralized very carefully with an alkali. Both of these preparations come in closed glass tubes containing nitrogen gas and the powder.

Atoxyl

This is Sodium Arsanilate, and comes in tablets of 0.02 gm. (gr. $\frac{1}{3}$) for hypodermic use.

Administration

Arsenic preparations should be given well diluted after meals.

CARDIAC STIMULANTS

The Circulation of the Blood

The blood supplies all the organs and tissues of the body with nourishment, and takes away their waste products. It reaches these organs and tissues, by being pumped by means of a complicated pump, the heart, to the various organs and tissues of the body along numerous small tubes which gradually grow smaller; the arteries.

The impure blood is then carried back to the heart from the tissues and organs, by means of a system of tubing called the veins.

The Heart

The heart is a pear-shaped organ, about the size of one's fist, situated in the left side of the chest. It consists of four chambers. Two of these chambers receive blood into the heart from the veins, and are called **Auricles,** and two of them send blood out to the organs and tissues of the body, and are called **Ventricles.**

The **right auricle receives** impure blood (blood containing waste products) from the various organs and tissues of the body. This impure blood is then pumped into the next chamber, which is the **right ventricle.** From the **right ventricle** this impure blood is pumped into a large artery, the **pulmonary artery,** to the lungs. Here some of the waste products of the blood are excreted, and instead, the red corpuscles **take up oxygen** from the air in the lungs.

This **purified blood** is then carried back along the **pulmonary veins,** to the **left auricle,** and from there it is pumped into the **left ventricle.** The **left ventricle** then pumps the blood into the large arteries; the **aorta and its branches.** The blood then passes through these arteries and their branches, to the various organs and tissues of the body, which are thus supplied with oxygen and nourishment. It then takes away the waste products from these tissues and organs, and brings them back again to the heart, and

then to the lungs, where they are excreted, and new oxygen obtained.

The passage of the blood, to the various parts of the body from the heart along the arteries, and then back again to the heart along the veins, is called the circulation of the blood.

The blood is kept circulating by the regular contractions of the heart, which in normal healthy individuals, occur about 72 times a minute.

Each contraction consists of two parts or phases.

1. The period of contraction, which is the time when the heart becomes smaller and expels its contents; the blood. This is called the **systole of the heart.**

2. The period of relaxation, which is the time when the heart becomes larger, and contains a greater amount of blood. This is called the **diastole of the heart.**

The heart contracts because of an intrinsic power of the heart muscle. This can be proven by the fact that the heart of an animal will contract for a little while, even when it is taken out of the body.

The contractions of the heart, however, can be affected by the following influences.

1. By **impulses** coming from the medulla of the brain along special nerves going to the heart called the **accelerator nerves.**

The impulses traveling along these nerves, cause the heart to beat **stronger and faster.** As a result of these impulses, the contractions or **systoles are stronger,** greater and **more frequent;** while the relaxation or diastoles of the heart are diminished.

2. By **impulses** coming from the medulla of the brain along special nerves going to the heart called the **Vagus, Pneumogastric or inhibitory nerves.** These impulses make the heart beat **slower and weaker.** As a result of these impulses, the relaxation period or **diastoles, are greater** and last longer. The contractions or systoles, therefore occur less frequently because the relaxation of the heart or diastole, takes up so much time.

3. **The width of the blood vessels,** especially the very small blood vessels, also influences the contractions of the heart.

When the **blood vessels are narrow, the heart must beat stronger and faster,** in order to pump the blood through narrower blood vessels; because the narrower the vessels are, the greater resistance do they offer to the contractions of the heart.

When the **blood vessels are wider,** the heart does not have to contract so forcibly to propel the blood through the blood vessels, because they offer no resistance to the flow of blood.

The width of the blood vessels is regulated by small muscle fibers in their walls. The contractions of these muscle fibers, makes the blood vessels narrower; and, by their relaxation, they make the blood vessels wider.

There are also impulses which are sent down from a spot of gray matter in the medulla of the brain (the vaso motor center), which cause these muscle fibers to either contract, or relax, and thereby regulate the size of the blood vessels.

Effects of Drugs on the Heart

Drugs affect the heart in two ways:

1. They **increase** its activity (stimulation).
2. They **diminish** its activity (depression).

Stimulation of the Heart

When drugs increase the activity of the heart, or stimulate it, they make the heart beat stronger and faster. The contractions or systoles of the heart are stronger, while the period of relaxation or diastole is lessened.

When the heart beats stronger and faster, the pulse is usually stronger and faster; because the character of the pulse depends largely on the contractions of the heart.

This **increased activity** of the heart is produced in several ways.

a. By acting directly on the **heart muscle** to make it contract more forcibly and more frequently.

b. By causing **more impulses** to be sent out from the medulla of the brain along the **accelerator nerves** which then make the heart beat stronger and faster.

c. By **paralyzing the nerve endings** in the heart of the **Vagus or inhibitory nerves,** so that all impulses which slow the heart, are cut off; and do not reach it. **The heart then beats stronger and faster;** the systoles or contractions are increased, while the diastoles or relaxations are diminished.

d. **By contracting the small muscle fibers in the walls of the small blood vessels,** the contractions of the heart are increased in strength and frequency, to overcome the increased resistance which the narrower blood vessels produce.

Many drugs increase the heart action in one or a number of these ways. Some drugs may increase the strength of the contractions though they may lessen their frequency.

This is often a very beneficial effect; because the individual contractions are stronger and the circulation of the blood is therefore better. The slow contractions of the heart, however, prevent the heart from becoming exhausted from overwork. For example, digitalis, which is an excellent heart stimulant, causes strcng contractions of the heart, though the heart beats slower.

Depression of the Heart

When drugs diminish the activity of the heart, or depress it, the heart beats slower and weaker. The contractions or systoles are lessened, while the period of relaxation or diastoles, are increased. The heart therefore beats slower and weaker. The pulse is therefore slower and weaker.

This action is produced in several ways.

a. **By directly affecting the heart muscle** so that the heart beats slower and the contractions are weaker.

b. **By sending impulses from the medulla** of the brain along the **Vagus or inhibitory nerves** to cause the heart to beat slower and weaker. This effect can also be produced by **increasing the action of the nerve endings** of the Vagus nerve in the heart; so that they will be more susceptible to receive such impulses.

c. **By paralyzing the nerve endings** in the heart of the accelerator nerves. The impulses for increasing the heart action are thus cut off; and the heart will then beat slower and weaker.

d. **By causing the small muscle fibers in the walls of the blood vessels to relax,** thereby widening these vessels. The heart will then have to contract less actively and slower.

Effects of Overdoses

In overdoses, the effects of either a heart stimulant or a depressant may be the same. For example, when the heart action is increased, the heart beats strong and fast, but when it is overacting and is exhausted, it may beat very slow and weak. In poisonous doses then, a heart stimulant may cause symptoms of depression.

A drug which lessens heart action, however, or a depressant, makes the heart beat slow and weak. In overdoses the heart will then beat even slower and still weaker.

HEART STIMULANTS

CAFFEINE (CAFFEINA)

Caffeine is a white crystalline powder, an alkaloid; the active principle of the coffee bean, **Coffea arabica:** of tea leaves, **thea chinensis** of China; **Paraguay tea** of Argentine; the **kola nut** of Central Africa and the **guarana paste** of Brazil.

Coffee was originally used by the Arabians; but it is now a universal beverage. The same effects can be obtained from coffee, as from caffeine; for the action of coffee is due principally to the caffeine which it contains.

Coffee and tea are very common beverages. They are infusions of the coffee bean or tea leaves. The coffee bean contains about ⅜% of caffeine. A cup of coffee contains about 0.1–0.2 gm. (grs. 1½ to iii) of caffeine.

Coffee has a laxative effect because of volatile oils which it contains.

Tea contains about 1½ to 2% of caffeine. A cup of tea also contains 0.1–0.2 gm. (grs. 1½ to iii) of caffeine. This is due to the fact that less tea is used in making tea.

Tea contains a large amount of tannic acid, however, which makes it contract mucous membranes (astringent action).

Appearance of the Patient

When a patient is given an average dose of caffeine, or

when a strong cup of coffee is taken, the following effects are noticed.

The patient is more wakeful, brighter, and is able to think quicker and better; and to reason better. In fact, all mental work can be done better and with less fatigue. The patient is more active and responds more easily, more rapidly and better, to all influences about him. The pulse is quicker and stronger; and the breathing is deeper and more frequent. The patient also urinates more frequently and passes more urine.

Caffeine is an ideal stimulant; because it increases the activity of almost every organ of the body. Its effects come on in about a half to one hour after it is given, and last only for one or two hours.

ACTION

Caffeine produces no effects when applied locally on either the skin or mucous membranes.

Internal Action

In the mouth: Caffeine has a slightly bitter taste.

In the stomach: It produces no effects; but it is absorbed into the blood through the lining membrane of the stomach in about half to one hour after it is taken.

In the intestines: Caffeine produces no effects. Coffee, however, because of a number of volatile oils which it contains, increases the peristalsis; causing mild movements of the bowels.

Action after Absorption

After it is absorbed into the blood, caffeine affects principally the heart, the blood vessels, the respiration, the muscles, the brain and the kidneys. The effects it produces last only for about one to two hours.

Action on the Heart: After ordinary doses of caffeine are given, **the heart beats stronger and faster.** This is due to the caffeine acting directly on the heart muscle, causing it to contract more vigorously and more often (increasing the systole but not the diastole).

Action on the Blood Vessels: The small blood vessels are

made narrower by contraction of the muscle fibers in their walls. Impulses are also sent to these muscles from the spot of gray matter in the medulla of the brain which controls their contractions (the vaso motor center), and therefore the width of the blood vessels. This effect helps to increase the strength and frequency of the heart beats, and also increases the pressure of the blood in the blood vessels (blood pressure).

As a result of these effects on the heart and blood vessels, **the pulse is rapid and strong** and the blood pressure (the pressure of the blood in the vessels) is increased.

Respiration: After caffeine the patient usually **breathes deeper and faster.** This causes more air to be taken into the lungs. More oxygen can therefore be taken up by the red blood corpuscles.

Muscles: Caffeine increases the contractions of all voluntary muscles (biceps, triceps, etc.) and these muscles contract with less fatigue. As a result of this action, individuals are able to do more physical work and with less fatigue.

Action on the Brain: Caffeine increases the action of every part of the brain. Impulses reach the brain faster. More impulses are sent out from the brain, and these are sent out more rapidly.

As a result of this action, the patient is more wakeful, brighter; he sees and hears better. He appreciates influences about him more easily and is able to respond to them more readily. The patient is able to think better, easier and faster. He reasons better, his ideas arise more easily and he can express these ideas with greater ease; and he can remember better. The patient is more active, more talkative, and absolutely rational in everything he says or does.

These effects result from increased action of the various regions of gray matter in the brain. For instance, the greater activity of the patient, is due to more impulses being sent out from that part of the gray matter of the brain which controls motion. The patient is brighter and wakeful because he is more susceptible to influences and impressions obtained from objects about him. He appreciates the

impressions received through his various senses much better, and this helps to keep him wakeful. He reasons better, because the impressions which are received in the brain are rapidly combined into new ones. The memory is better, because impulses are sent out from the various parts of gray matter of the brain where old impressions had been stored up.

Action on the Spinal Cord: The action of the spinal cord is increased by caffeine. As a result of this, the patient responds quicker and more actively to impressions received through his various senses (reflex action). For instance, the bowels move better because they respond faster when they become distended; the patient also responds much faster to any impression received through his senses such as pain, for instance.

Action on the Kidneys: Caffeine increases the flow of urine. It causes the cells of the kidney to secrete more urine. By increasing its circulation it also brings more blood to the kidney from which it can secrete more urine. Caffeine is therefore one of the best diuretics.

Excretion

Caffeine is excreted mainly by the kidneys in a few hours. Very little caffeine is excreted as such. Most of it is changed to urea, which is a normal constituent of urine.

Poisonous Effects

Acute caffeine poisoning is very rare, because the caffeine is excreted very rapidly. The following symptoms were present in a few cases that have occurred:

1. Headache.
2. Confusion.
3. Noises in the ear.
4. Flashes of light.
5. Delirium.
6. Palpitation of the heart.
7. Rapid weak pulse.
8. Short quick breathing.

9. Convulsive movements of the hands and tremors of various parts of the body.
10. Profuse flow of urine.
11. Collapse (pallor, cold moist skin, rapid thready pulse, slow and shallow breathing, cold extremities).

Chronic Caffeine Poisoning—" Coffee Habit "

This occurs particularly in people who drink strong coffee habitually.

The patient is very nervous, is easily excited and disturbed even by the slightest noise. He is unable to sleep, complains of headache, palpitation of the heart and trembling of the fingers and hands.

When the patient stops drinking coffee, all these symptoms disappear.

Administration

Caffeine is given in capsules, tablets or powders. Since its effects come on rapidly, and do not last for a long time, it is better to give small doses, frequently repeated, than a single large dose; so that when the effect of one dose wears off, the patient has some more caffeine to produce its effects.

Uses

Caffeine is one of the best drugs to increase heart action, especially where a rapid effect is desired. It is an excellent diuretic. It is very often combined with other drugs such as phenacetine, acetanilid, etc., to overcome their weakening action on the heart.

Preparations

Caffeine (Caffeina)	0.06–0.3 gm.	grs. i–v
Caffeine Citrate (Caffeina Citrata)	0.06–0.5 gm.	grs. i–viii
Effervescent Caffeine Citrate (Caffeina Citrata Effervescens)	4.0 gms.	ʒi

This is a mixture of caffeine citrate, sodium bicarbonate,

tartaric acid and sugar, containing 4% of caffeine citrate. It effervesces when dissolved in water.

Caffeine Sodium Benzoate (Caffeina Sodii Benzoas) (Unofficial)	0.06–0.3 gm.	grs. i–v

This is an excellent preparation for hypodermic use. It is usually kept in 25% stock solutions.

Guarana

Guarana is a paste made from the seeds of **Paullinia sorbilis**, a Brazilian plant. It contains **caffeine and tannic acid.** It is used for sick headache and neuralgia. In Brazil, it is also used to check diarrhoea because of the tannic acid which it contains.

Preparations

Fluidextract of Guarana (Fluidextractum Guaranae)	4.0–8.0 c.c.	ʒi–ii

There are numerous preparations of the kola nut on the market. Many of them are used as stimulating drinks. They all contain caffeine.

DIGITALIS GROUP

The drugs in the following group, have practically the same action with slight differences. The most efficient, and best drug of the group is digitalis. The most important drugs in this class are,

Digitalis Purpurea, Purple Foxglove
Strophantus Hispidus or Kombe, Strophantus
Scilla Maritima, Squills

The following ones are less frequently used:

Convallaria Majalis, Lily of the valley
Helleborus Niger, Christmas rose
Apocynum Canabinum, Canadian hemp
Adonis Vernalis, Pheasant's eye
Antiaris, Upas tree
Nerium, Oleander

and a number of others.

Some of these drugs, for example strophantus, were used

by the natives of Africa and in other Eastern countries as arrow poisons. Others were known for a long time before they were ever used in medicine.

DIGITALIS

Digitalis is a drug obtained from the leaves of the **Digitalis purpurea,** or **Purple foxglove,** which grows in most temperate climates. The English leaves are the best.

The leaves of the second year's growth are mostly used in making digitalis preparations, because they contain the largest amount of the active principles.

There are four active principles in digitalis. All of them are glucosides. It also contains one inactive glucoside.

The active glucosides in the order of their activity are:

Digitoxin
Digitophyllin
Digitalin
Digitalein

The inactive glucoside is **Digitonin.**

The active glucosides can all be dissolved in alcohol, while the digitonin can be dissolved in water. The tincture of digitalis therefore, does not contain any digitonin.

The presence of the digitonin in the leaves, enables the active glucosides to be dissolved in water. Owing therefore, to the digitonin, it is possible to make up such preparations as the infusion or fluidextract. These preparations cannot be made if the digitonin is removed from the leaves, because the active glucosides cannot be dissolved in water.

There are certain preparations of digitalis which are made from the seeds. They are called digitalines, and are unofficial. They contain digitalin and digitalein, and very small quantities of digitoxin, which is the most active glucoside of all. They are not very active preparations and are very unreliable.

The most potent glucoside of digitalis is **Digitoxin;** which produces most of the digitalis effects.

ACTION

Local Action: Applied to the skin, digitalis causes smart-

ing. If it is injected hypodermically, it is injurious to the tissues. It often causes inflammation and occasionally an abscess.

On mucous membranes: It causes pain, redness, profuse secretion of mucus, and often inflammation. For example, if it is applied on the mucous membrane of the eye (conjunctiva) it causes redness, inflammation, and profuse flow of tears. If applied on the mucous membrane of the nose, it causes sneezing, profuse flow of mucus from the nose, ("running nose" or coryza) and inflammation.

Internal Action

In the mouth: Digitalis has a bitter taste and causes a burning sensation.

In the stomach: many of the preparations of digitalis cause nausea and vomiting, because of the redness and swelling of the lining membrane of the stomach which they produce. This is due to the digitonin which these preparations contain. The preparations that do not contain digitonin, such as the tincture, or some of the newer preparations, are not so apt to cause nausea and vomiting.

In the intestines: Digitalis occasionally causes diarrhoea, because of the redness and inflammation of the lining membrane of the intestines, which it produces.

Action after Absorption

Digitalis preparations are very slowly absorbed into the blood, through the lining membrane of the stomach. It usually takes about 12 to 24 hours to produce its effects. If given hypodermically, it enters the blood somewhat faster, so that the effects come on more rapidly.

Since digitalis is so slowly absorbed, it produces continuous lasting effects. It is, therefore, the best drug to give to a patient suffering from weakened heart action (myocardial insufficiency).

After absorption, digitalis affects principally the heart, the blood vessels and the medulla of the brain.

Action on the Circulation

This is the most important action of digitalis.

Action on the Heart: Digitalis makes the heart beat stronger and slower. It makes the heart muscle contract more vigorously, so that the heart completely expels its blood into the blood vessels (increases the systole). It also causes more impulses to be sent from the medulla of the brain along the Vagus or inhibitory nerves, which carry impulses to slow the heart, which, therefore, beats slower. The period of relaxation of the heart (diastole) is then greater, because the heart has more time to dilate or relax, between each contraction.

The total effect on the heart is, that more blood enters the cavities of the heart during its period of relaxation; which is greater. More blood is pumped into the blood vessels; to be carried to the various organs and tissues of the body, owing to the stronger contractions of the heart.

Action on the Blood Vessels: Digitalis contracts the muscle fibers in the walls of the small blood vessels, thereby making these **vessels narrower.** The narrower blood vessels, offer a greater resistance to the contractions of the heart. This greater resistance helps to increase the contractions of the heart muscle. More impulses are also sent from the medulla to make these muscle fibers contract.

The pressure of the blood within the blood vessels (blood pressure) is much greater after digitalis. This is due to:

1. The greater muscular contractions of the heart muscle itself, which sends more blood into the arteries with greater force.

2. The contractions of the muscle fibers in the walls of the blood vessels, making these vessels narrower, helps to increase the pressure of the blood.

The total effect of digitalis on the circulation is to produce:

Regular strong slow contractions of the heart with greater blood pressure. The pulse is therefore slow, strong, regular and tense.

More blood is pumped to the different tissues and organs of the body with greater force. The blood is better in quality, because it has been purified by a greater amount of air in the lungs. The various parts of the body are all supplied with more, and better blood, and are able to do their work better.

The effect of digitalis on the heart can be compared to a driver driving a lagging horse. The lagging horse is the weakened heart, which is not doing enough work. The driver is the digitalis.

The driver whips the horse to make him go faster and more energetically; but, lest the horse overwork himself by going too fast, the driver keeps him in check by pulling in the reins. The horse then works energetically, though not fast enough to exert himself.

After digitalis, the heart also works energetically, but lest it overwork itself, it is checked by the slowing impulses of the Vagus or inhibitory nerves, which prevent it from becoming exhausted.

Action on the brain: Digitalis affects the medulla of the brain, especially that part of the gray matter of the medulla, which sends out impulses to slow the heart (vagus center), and the part of gray matter for sending impulses to contract the muscle fibers of the blood vessels (vaso motor center). In overdoses, it also sends out impulses for vomiting; and in such doses the impulses for motion are also very much increased, thereby producing convulsions.

Action on the kidney: Digitalis increases the flow of urine very markedly; especially in cases where the tissues contain a great deal of fluid (oedema). This is due to the improvement of the circulation of the kidney, which results from digitalis. The improvement of the circulation throughout the body causes the absorption of the fluid from the tissues, lessening the oedema. The absorbed fluid is brought to the kidneys. This helps to increase the secretion of urine; since there is more fluid to be excreted.

Temperature: Digitalis often lowers the temperature.

Excretion

The body gets rid of digitalis very slowly. It begins to be excreted a few days after it is given. As a result of its slow excretion, some of the digitalis accumulates in the body, and cumulative symptoms, or chronic digitalis poisoning results.

Poisonous Effects

Since digitalis is slowly absorbed, and excreted still slower, it does not cause acute poisonous symptoms.

Digitalis Poisoning or Cumulative Symptoms

Cumulative symptoms result from continued administration of digitalis. These can often be avoided, by giving digitalis for a time; then stopping its administration for a while, to allow the body to get rid of the digitalis which it has accumulated.

Symptoms

The first symptom of excessive digitalis action, is *continuous nausea and vomiting*, lasting for two or three days. There may also be *diarrhoea*. The patient then complains of *weakness, headache and disturbance of vision.* (He may be unable to see objects clearly, they may seem to vibrate, and there may be spots before the eyes.) There may also be buzzing in the ears, often the patient feels dizzy.

The pulse becomes slow, about 40 to 50 beats to the minute, irregular, weak and small. On the slightest exertion, however, the pulse becomes very rapid, even 130 or 150 beats to the minute, though it is very weak and irregular. *The breathing is rapid and shallow. Very little urine is passed.*

The continuous vomiting finally exhausts the patient. The face is pale, the eyeballs protrude, the pupils are dilated, the pulse becomes very rapid, intermittent and weak. The breathing becomes very rapid and shallow. The patient is conscious, however, though he may be *delirious*. Finally *convulsions* develop, and death ensues.

Death usually occurs in two or three days from weakened heart action.

The most important symptom of digitalis poisoning, is **the slow and irregular pulse.** Whenever digitalis is given to a patient, and the pulse gets to about 40 or 50 and becomes irregular, it means the patient is getting too much digitalis and the drug should be stopped.

The excessive slowness of the pulse means that the heart is overworking, and impulses are being sent along the Vagus

nerves to check this overwork. These excessive impulses to slow the heart cause the slow pulse. If, however, digitalis is still given, in spite of the slow pulse, the vagus nerve becomes paralyzed; and its influence on the heart is gone. The heart then beats very rapidly and the pulse is very rapid and intermittent. This occurs in the late stages of digitalis poisoning.

Treatment of Digitalis Poisoning

1. Stop the digitalis as soon as the pulse gets below 50 and is irregular.

2. Keep the patient absolutely quiet; because a sudden exertion may be fatal.

3. Wash out the stomach.

4. Give cathartics to clean out the bowels.

5. Give preparations of tannic acid or tannin (such as old tea) to neutralize the digitalis.

6. Give alcoholic preparations such as whiskey, or ammonia preparations such as ammonium carbonate, to keep up the heart action.

7. Give preparations of opium or morphine to keep the patient quiet and prevent the heart from overacting.

Administration

For rapid effect, as in collapse, only some of the newer unofficial preparations can be given. They act quicker than other preparations and can be given hypodermically.

All preparations of digitalis should be given after meals. They should be fresh and made from reliable English leaves. The failure to obtain results from digitalis is often due to unreliable preparations.

Weakened Heart Action or Myocardial Insufficiency

The contractions of the heart keep the blood circulating through the blood vessels, so that the tissues and organs of the body may be supplied with nourishment and oxygen, and their waste products removed.

When the heart is diseased; for example, when its valves are narrowed (stenosis), or when they are leaking (regurgitation), the heart overcomes this difficulty, by its wall

getting thicker; so that the heart is then able to contract with greater force to overcome the leaking or narrow valves. The heart is then said to be compensated.

When, however, the heart muscle is weak, the blood cannot be moved along the blood vessels fast enough. Some of the blood then accumulates in the veins of the lungs, of the extremities and of the abdomen.

When the blood accumulates in the blood vessels of the lungs, the air sacs become narrower. The patient therefore, has to breathe faster and deeper to get the proper amount of air in his lungs. The blood corpuscles therefore, do not take up enough oxygen, and the blood is then darker in color and the patient looks blue.

Some of the blood also accumulates in the veins and capillaries of the extremities. Some of the serum of this accumulated blood, oozes through the walls of the vessels into the surrounding tissues. The tissues, particularly of the lower extremities, then become full of fluid (oedema).

In the abdomen too, the accumulation of the blood, in the blood vessels of the stomach and intestines, results in congestion and oedema of the stomach and intestines. This produces nausea, vomiting and diarrhoea.

The accumulation of the blood in the kidneys, results in lessened secretion of urine, because the kidney is not supplied with sufficient fresh blood from which to excrete urine.

Often the serum oozes through the walls of the blood vessels into the abdomen, filling it up with fluid (ascites).

As a result of this weakened heart action, patients present the following picture:

At first they are **very short of breath and the face is blue** (cyanosed). Later **the extremities are swollen** (oedema), and in some cases, the patients have nausea, vomiting and even diarrhoea. **The pulse is rapid, often irregular and weak.**

Appearance of the Patient after Digitalis

When digitalis is given, all these symptoms disappear. Within a few days after its administration is begun, the patient breathes easier, the blueness of the skin disappears. The swelling of the extremities (oedema) gradually becomes

lessened, until it finally disappears. The pulse is stronger and slower. More urine is passed and the nausea and vomiting disappear.

Preparations

Solid Preparations

Digitalis (Powdered leaves) (Digitalis)	0.03–0.1 gm.	grs. ½–ii
Extract of Digitalis (Extractum Digitalis)	0.0075–0.03 gm.	grs. ⅛–½

Fluid Preparations

Infusion of Digitalis (Infusum Digitalis)	4.0–16.0 c.c.	℥i–℥½

The usual official infusion is a 1.5% solution, or one part of digitalis to 66⅔ parts of water.

Many physicians order weaker infusions; such as 1–150 etc. The dose for such infusions is correspondingly greater.

Fluidextract of Digitalis (Fluidextractum Digitalis)	0.06–0.12 c.c.	m. i–ii
Tincture of Digitalis (Tinctura Digitalis)	0.3 –1.0 c.c.	m. v–xv

This preparation does not contain digitonin, and is therefore not so apt to upset the stomach.

New and Non-official Preparations

The following preparations are not official. Many of them are used extensively and are very reliable. Some of them can be given hypodermically, because they do not form abscesses and produce effects rapidly.

Digalen (Liquor Digitoxin Solubilis)	0.06–2.0 c.c.	m. x–xxx

Digalen is a solution containing digitoxin, the most active glucoside of digitalis. It is dissolved in a mixture of distilled water, glycerin and a very small amount of alcohol. The digitoxin in this preparation has been prepared so that it may be easily dissolved. It is given hypodermically, and produces its effects in from one to two hours.

It is also given intravenously in doses of 0.3—1.0 c.c. (m. v–xv) producing effects in from 15 minutes to a half hour. It can be repeated intravenously in these doses about every half to one hour.

Digalen Tablets: Each tablet contains the same amount of digitoxin that is contained in 0.5 c.c. (m. viii) of digalen.

Digipuratum: Digipuratum is a preparation of digitalis from which many of the inactive substances have been removed. It contains no digitonin, and is therefore not apt to cause nausea and vomiting.

It is made from specially grown leaves, and the dose is regulated and accurate. Each dose contains enough digitoxin to kill a frog weighing 30.0 gms. by stopping the beating of its heart.

Digipuratum Tablets	0.1 gm.	gr. i½

These tablets are given in the following way; one tablet four times a day, and giving one tablet less every day, until ten tablets are taken. The digipuratum is then stopped. This allows the body to get rid of the drug which it has accumulated. Cumulative symptoms are thus avoided.

Digipuratum also comes in vials for hypodermic use. Each vial contains 1.0 c.c. of fluid, and is equivalent to 0.1 gm. (gr. i½) of digipuratum.

Digitoxin	0.00025 gm.	gr. $\frac{1}{250}$

This is not often used, as it cannot be dissolved easily.

Digitol	0.3–1.0 c.c.	m. v–xv

There are several preparations of digitalins. Some of them are called German or French digitalins. They are not used very much because their action is unreliable. Many of them are made from the digitalis seeds, and contain very few active principles.

STROPHANTUS (STROPHANTUS)

Strophantus is a drug obtained from the ripe seeds of the **Strophantus hispidus,** a climbing shrub of Africa. It has been used for a long time by the natives of that country, as

an arrow poison under various names; such as kombé, ineé, ouaye, or pahouius poison.

Its active principle is a glucoside, **strophantin.**

ACTION

Strophantus produces the same effects as digitalis.

Local Action: Applied to the skin, it causes smarting. If injected hypodermically, it is apt to cause abscesses.

On mucous membranes: It causes intense redness, swelling, profuse secretion of mucus, and often inflammation.

Internal Action

In the stomach: It slightly increases the secretion. It does not cause nausea and vomiting.

In the intestines: The secretions of the mucous membrane are slightly increased.

Action after Absorption

Strophantus is absorbed more rapidly than digitalis, usually in about 12 hours. After absorption, it affects principally the heart, muscles and the kidney.

Action on the Heart: Strophantus makes the **heart beat slower and stronger.** The pulse is strong and slow like the digitalis effect. Strophantus **does not contract the blood vessels** as much as digitalis.

Action on the Muscles: One of the most important effects of strophantus is its action on the muscles. It makes them contract more vigorously.

Action on the Kidneys: Strophantus increases the flow of urine because it improves the circulation of the kidney.

Excretion

Strophantus is excreted mainly by the kidneys; much more rapidly however, than digitalis. It does not therefore, cause cumulative symptoms.

Poisonous Effects

The poisonous symptoms of strophantus are the same as those of digitalis. (See Digitalis.)

Uses

Strophantus is often used instead of digitalis, when the patient cannot stand the ordinary digitalis preparations, because of the nausea and vomiting which these often produce.

Preparations

Tincture of Strophantus (**Tinctura Strophanti**)	0.3–1.0 c.c.	m. v–xv
Strophantin (The active glucoside)	0.001 gm.	gr. $\frac{1}{60}$

This is not very reliable, since its composition varies. It must be freshly prepared.

Ouabain (**Crystallized Strophantin**) (Unofficial)	0.003–0.025 gm.	gr. $\frac{1}{20}$–$\frac{2}{5}$

This is also given intramuscularly, well diluted in doses of gr. $\frac{1}{130}$.

Ouabain is a preparation of strophantin which is said to be more active than the ordinary strophantin.

SQUILLS (SCILLA)

Squills is obtained from the bulb of the **Unginea maritima** or **squills maritima,** or the sea onion, a plant growing in the southern part of Europe. The outer coat of the bulb is removed, and the bulb is then cut into slices. From these slices the preparations are made. The active principle is a glucoside, **scillain.**

ACTION

Squills acts mainly like digitalis.

Local action: Applied to the skin, it causes smarting and pain. **On mucous membranes,** it causes redness, swelling, with excessive secretion of mucus.

The mucous membrane of the eye, the nose, are all affected by squills. It makes them all secrete mucus very profusely.

Internal Action

In the mouth: Squills has a bitter taste.

In the stomach: It often causes nausea and vomiting, owing to the profuse secretion of the lining membrane of the stomach which it produces.

In the intestines: It often causes diarrhoea.

Action after Absorption

Squills is absorbed much faster than digitalis. After absorption it acts upon the heart, the blood vessels, mucous membranes and the kidneys.

Action on the heart: Squills acts like digitalis on the heart. It makes it **beat stronger and slower.** The pulse after squills is therefore stronger and slower.

Action on mucous membranes: Squills increases the secretion of all the mucous membranes when given internally, especially the mucous membrane of the bronchi. It is used very often as an expectorant; to increase the cough and expectoration, particularly in old people.

Action on the kidney: It increases the flow of urine by improving the circulation of the kidney. It is often given together with digitalis for this purpose.

Excretion

Squills is excreted by the kidneys; more rapidly than digitalis.

Poisonous Effects

Overdoses of squills cause the following symptoms:

1. Severe abdominal pain.
2. Violent nausea and vomiting.
3. Profuse diarrhoea.
4. Scanty urination, often with bloody urine.
5. Slow pulse.
6. Collapse; (rapid, thready, weak pulse, slow and shallow breathing, pale, cold, moist skin).
7. Convulsions; usually before death.

Treatment

1. Wash out the stomach.
2. Give cathartics to move the bowels.
3. Treat the collapse: Keep the patient warm; give heart stimulants such as caffeine, strychnine, atropine, etc.

Preparations

Tincture of Squills (Tinctura Scillae)	0.3–1.0 c.c.	m. v–xv
Syrup of Squills (Syrupus Scillae)	2.0–4.0 c.c.	ʒ½–i
Compound Syrup of Squills (Syrupus Scillae Compositus)	0.6–2.0 c.c.	m. x–xxx

This contains squills, senega and tartar emetic.

Guy's or Fothergill's Pill

This contains:
Calomel
Squills
Digitalis (powdered leaves) of each 0.06 gm. (gr. i). It is an excellent diuretic.

Squills is usually given in pill form for diuretic action. As an expectorant the syrup is usually given.

CONVALLARIA (LILY OF THE VALLEY)

Convallaria is obtained from the roots and underground stems of the **Convallaria majalis** or **lily of the valley.**

The active principles are glucosides; **convallarin** and **convallamarin.**

Convallamarin acts on the heart, while convallarin acts on the stomach and intestines.

ACTION

Convallaria acts like digitalis, but it is not as reliable.

Local action: Applied to the skin, the preparations of convallaria cause smarting and pain.

On mucous membranes: It causes redness and swelling, with profuse secretion of mucus.

Internal Action

In the stomach: It often causes nausea and vomiting.

In the intestines: It increases the secretion of the lining membrane, often causing diarrhoea.

Action after Absorption

Convallaria is absorbed from the stomach more rapidly than digitalis.

After absorption, it affects principally the heart, blood vessels and kidney.

Action on the heart: Convallaria makes the heart beat stronger and slower. It also contracts the blood vessels. The pulse is therefore slow and strong, and the blood pressure is greatly increased.

Action on the kidney: Convallaria increases the flow of urine by improving the circulation of the kidney.

Excretion

Convallaria is excreted mainly by the kidney; more rapidly than digitalis. It does not cause cumulative symptoms.

Uses

Convallaria is used as a substitute for digitalis to relieve dropsy (fluid in the tissues), in heart disease and kidney disease. It is not as efficacious nor as reliable as digitalis.

Convallaria was used for dropsy by the Russian peasants long before it was ever used in medicine.

Poisonous Effects

The poisonous symptoms of convallaria are quite similar to those of digitalis.

The following are the usual symptoms of an overdose.

1. Nausea, vomiting.
2. Diarrhoea.
3. Slow irregular pulse with very high blood pressure. Later the pulse becomes very rapid.
4. Deep prolonged breathing, which later becomes slow and deep.

The patient finally dies from stopping of the heart action.

Treatment

1. Stop the drug.
2. Wash out the stomach.
3. Give cathartics.
4. Give heart stimulants if necessary.

Preparations

Fluidextract of Convallaria (Fluidextractum Convallariae)	0.3–1.0 c.c.	m. v–xv
Convallarin (Convallarinum) (Not official)	0.03–1.2 gm.	gr. ½–ii

This is not often used because it is unreliable.

APOCYNUM (CANADIAN HEMP)

Apocynum is obtained from the root of the **Apocynum cannabinum, Canadian hemp** or **milkweed.**

Its active principle is a glucoside **apocynein.** Apocynin is another inactive principle present in apocynum.

ACTION

Apocynum produces the same effects as digitalis.

Local action: Applied to the skin, it causes smarting and redness. **On mucous membranes** it causes redness, swelling and excessive secretion of mucus.

Internal Action

In the stomach: It often causes nausea and vomiting by increasing the secretion of the mucous membrane of the stomach.

In the intestines: It increases the secretion of the mucous membrane, thereby producing diarrhoea.

Apocynum is an excellent laxative in small quantities, but it is not often used for this effect.

Action after Absorption

Apocynum is slowly absorbed; though much more rapidly than digitalis. After absorption it affects principally the heart and the kidneys.

Action on the heart: The heart beats slower and stronger; the pulse is therefore slow and strong after apocynum is given.

Action on the kidneys: It increases the flow of urine by improving the circulation of the kidney.

Excretion

Apocynum is excreted mainly by the kidney.

Uses

It is used principally as a diuretic, but its action cannot be relied upon.

The **poisonous effects** are the same as those of digitalis.

Preparations

Fluidextract of Apocynum (Fluidextractum Apocyni)	0.3–2.0 c.c.	m. v–xxx

ADONIS VERNALIS (not official)

Adonis vernalis is the root of the **Adonis vernalis,** a plant of northern Europe and Asia.

Its active principle is a glucoside, **adonidin.**

ACTION

Adonis vernalis acts exactly like digitalis. It is more rapidly absorbed, however, and does not cause cumulative symptoms. It is used as a substitute for digitalis, or it is occasionally given with digitalis.

It is very expensive and its effects are not reliable.

Preparations

Infusion of Adonis Vernalis
1–4% in strength

Adonidin (active principle) (Not official)	0.02 gm.	gr. $\frac{1}{3}$

TABLE OF COMPARATIVE ACTION OF DIGITALIS GROUP

Name of Drug	Skin and Mucous Membrane	Stomach and Intestines	Rate of Absorption	Heart	Blood Vessels	Muscle	Brain	Kidneys	Poisonous Effects
Digitalis.	Redness and smarting on skin. Profuse secretion of mucus.	Nausea, vomiting and diarrhoea.	Slowly absorbed.	Slow and strong contractions.	Contracted.	No action.	Increases impulses from medulla. Convulsions in overdoses.	Diuretic.	Cumulative action.
Strophantus.	Same.	No nausea, vomiting or diarrhoea.	More rapidly absorbed.	Same.	No action.	Increases muscular contraction.	No action.	Same.	No cumulative action.
Squills.	Increases secretion of mucous membranes after absorption. Used as expectorant.	Nausea, vomiting and diarrhoea.	More rapidly absorbed.	Same.	No action.	No action.	No action.	Marked diuretic action.	No cumulative action. Causes suppression of, and bloody urine.
Convallaria.	Redness and smarting on skin. Profuse secretion of mucus.	Same.	More rapidly absorbed.	Same.	Contracts blood vessels markedly. Greatly increased blood pressure.	No action.	No action.	Same.	No cumulative action.
Apocynum. (Action not always reliable.)	Same.	More nausea and vomiting. Good cathartic.	Same.	Same.	Contracts blood vessels.	No action.	No action.	Same.	No cumulative action.
Adonis Vernalis (Unstable. Action unreliable.)	Same.	Nausea, vomiting and diarrhoea not marked.	Same.	Same.	Same.	No action.	No action.	Slightly diuretic.	No cumulative action.

CAMPHOR (CAMPHORA)

Camphor is obtained from the **Laurus camphora** or **Cinnamomum camphora,** an evergreen tree growing in China and Japan.

It is made by chopping up the root, stems and branches of the tree into fine pieces and boiling them in water. The volatile oil which the plant contains then rises to the top. When the fluid is allowed to cool, part of the oil evaporates and leaves a thick film; which is the camphor. This is then skimmed off, purified and used as a drug.

This sediment which remains when a volatile oil evaporates is called a **stearoptene.**

Another similar stearoptene used in medicine is menthol, which is obtained from the oil of peppermint.

Thujon is a substance similar to camphor which is present in the oil of wormwood, and therefore in absinthe, and causes the convulsions of chronic absinthe drinkers.

Camphor has been used by the Chinese for many centuries.

Appearance of the Patient

About a half to one hour after an ordinary dose of camphor is given, the patient becomes calm and quiet, though somewhat exhilarated. He has a feeling of warmth in the stomach. The pulse is strong and rapid (sometimes slow) and the patient breathes faster and easier. When it is given hypodermically, these effects come on sooner.

ACTION

Local action: Applied to the skin, camphor causes redness and a feeling of warmth. It relieves pain at the spot where it is applied, and is slightly antiseptic.

On mucous membranes: It causes redness with profuse secretion of mucus.

Internal Action

In the mouth: It has a hot bitter taste.

In the stomach: It causes a feeling of warmth, checks the

formation, and hastens the expulsion of gas (carminative action).

In the intestines: It often checks diarrhoea and aids in the expulsion of gas.

Action after Absorption

Camphor is absorbed from the stomach in a few hours. After absorption it affects principally the heart, the respiration, the brain and slightly the muscles.

Action on the heart: Camphor makes the heart beat stronger. The rate may be faster or slower.

The blood vessels are widened however, so that the pulse has a bounding quality. The pulse is therefore always stronger and bounding, sometimes faster and at other times slower.

Action on the respiration: Camphor makes the patient breathe faster and deeper. This action is not always marked.

Action on the brain: In the doses that camphor is usually given, it makes the patient feel calm and quiet, though somewhat exhilarated. This is produced by slightly lessening the action of the brain. In larger doses the action of the brain is increased. The patient then becomes more active and more talkative.

In poisonous doses, the action of the brain is increased so much, the brain sending out so many impulses, for motion, speech, etc., that it often causes convulsions and delirium.

Action on the muscles: Camphor slightly increases the contractions of the muscles.

It often also increases sexual excitement.

Excretion

Most of the camphor that is taken, is used up by the tissues of the body. The rest of it is changed to camphorol, which is eliminated from the body by the kidneys; in combination with other ingredients of the urine. Camphor is excreted in a few hours.

Poisonous Effects

Overdoses of camphor produce the following symptoms; though they are rarely fatal:

1. Burning pain in the stomach.
2. Headache.
3. Dizziness.
4. Delirium.
5. Convulsions.
6. Unconsciousness.
7. Weak small pulse, rapid or slow.
8. Pale, cold moist skin.

These symptoms disappear when the drug is stopped.

Uses

Preparations of camphor such as the liniment, are used to relieve pain; in sprains or muscular rheumatism.

It is used as a heart stimulant, and often to lessen nervousness.

Recently, pneumonia has been treated by repeated intramuscular injections of 10 c.c. (ʒii½) doses of camphor oil.

This treatment is used, because it has been found that camphor checks the growth of the Pneumococcus, the bacterium which causes pneumonia. It is then supposed to act as a specific in pneumonia, and at the same time to strengthen the heart action.

Preparations

Solid Preparations

Camphor (Camphora)	0.1–0.6 gm.	grs. ii–x
Monobromated Camphor (Camphora Monobramata)	0.3–1.0 gm.	grs. v–xv

This is occasionally used to relieve nervousness, hysteria, and sexual excitement.

Fluid Preparations

Camphor Water (Aqua Camphorae) (Strength 1–125)	1.0–4.0 c.c.	m. xv–ʒi

Spirits of Camphor 0.3–2.0 c.c. m. v –xxx
(Spiritus Camphorae)
(Strength 10%)

This is much stronger than the camphor water.

Camphor Oil 0.3–0.6 c.c. m. v–x
(Oleum Camphorae)

This is rarely used.

Camphor Liniment or Camphorated Oil 2.0 c.c. m. xxx
(Linimentum Camphorae)

This is a 20% solution of camphor in cottonseed oil. It is used locally to relieve pain.

It is extensively used, however, for hypodermic use as a heart stimulant; and in doses of 10 c.c. in the treatment of pneumonia. It should always be injected deeply into the muscles.

Soap Liniment
(Linimentum Saponis)

This contains about 5% of camphor, 6% of soap, 70% of alcohol, and oil of rosemary. It is used locally to relieve pain.

AMMONIUM

Ammonium is a solution of ammonia gas in water. Ammonia is a combination of one part of nitrogen gas and three parts of hydrogen gas. Ammonia gas is formed when animal matter decays. It is a strong alkali.

Appearance of the Patient

When ammonia gas is inhaled, it causes redness of the conjunctiva of the eye, a profuse flow of tears, and a profuse flow of mucus from the nose, and sneezing; due to the redness and swelling of the mucous membranes.

It also causes severe coughing with excessive secretion of mucus from the bronchi. This is due to the redness and

swelling (irritation) of the lining membrane of the bronchi which ammonia produces. The pulse is stronger and faster, and the breathing is deeper and more rapid.

These effects come on almost immediately, but last for a very short time.

ACTION

Local action: A weak solution of ammonia causes redness and softening of the skin. It makes the skin feel slippery, as if it were covered with soap. Stronger solutions, if kept in contact with the skin and prevented from evaporating, form blisters (vesication), often destroying the skin (escharotic action).

On mucous membranes: It causes redness and swelling with profuse secretion of mucus. The same destructive action as on the skin, results if it is allowed to remain in contact with the mucous membrane. For example—on the conjunctiva it causes redness and profuse flow of tears. **In the nose:** It causes redness, swelling, profuse flow of mucus and sneezing. **In the bronchi:** When inhaled, or when given internally, it causes an excessive secretion of mucus which is somewhat more fluid in character.

Internal Action

In the mouth: Ammonia has a pungent taste, it causes redness and swelling of its lining membrane, and it increases the flow of saliva.

In the stomach: It causes redness and swelling of the mucous membrane and increases the secretion of gastric juice. It neutralizes the hydrochloric acid of the gastric juice so that it therefore lessens the digestion of food.

When ammonia is absorbed from the lining membrane of the stomach, it produces no effects; because it is changed at once to urea, one of the constituents of the urine. It increases however, the amount of urea in the urine.

Ammonia is usually given by inhalation and it produces its effects in this manner. The effects are not very lasting. When given by the mouth, the same effects are produced, and they are then more lasting; though the drug is not absorbed from the stomach.

Action after Inhalation

Ammonia affects principally the heart and the respiration.

Action on the heart: It makes the heart beat stronger and faster, causing a strong and fast pulse.

Action on the respiration: The breathing is more rapid and deeper after ammonia.

These effects are not due to absorption of the drug, but to the redness and swelling (irritation) of the mucous membrane of the eyes, nose and bronchi.

This irritation also affects the nerve endings in these mucous membranes, which then send impulses to the medulla of the brain. The medulla at once sends back impulses along the accelerator nerves, to make the heart beat stronger and faster, and to increase the depth and frequency of the breathing (reflex action). These effects appear almost immediately, and last for a very short time.

When given by the stomach, the same effects are produced, but they are more lasting. The effects are not produced by the absorption of the drug, but by the reflex action resulting from the redness and swelling (irritation) produced on the mucous membrane of the stomach.

Excretion

Ammonia is excreted as urea, a normal ingredient of the urine. The urine therefore contains a larger amount of urea. It is also excreted by the profuse secretion of the mucous membrane of the bronchi which it produces.

Effects after Intravenous Injections

If ammonia or any of its salts are injected into the veins, it markedly increases the frequency and depth of breathing. It makes the heart beat stronger and faster, and it often causes convulsions.

Poisonous Effects

Acute Ammonia Poisoning

When a strong solution of ammonia is taken, the following symptoms result almost immediately.

The patient complains of **severe burning pain in the mouth, throat and stomach.** The lips, mouth, throat, oesophagus and larynx are inflamed and swollen. Often the superficial tissues of these organs are destroyed. The **swelling of the larynx** may be so severe as to **obstruct the breathing** and the patient may **choke to death** because he is unable to get air into his lungs.

In addition to these symptoms, the patient feels **nauseated,** and **vomits profusely.** The vomited matter contains blood and pieces of the mucous membrane of the stomach.

The continual vomiting and the destruction of the lining membrane of the stomach, produce **severe collapse:** Pale, cold moist skin; rapid, weak, thready pulse; slow, shallow breathing; finally stupor, coma and death. Sometimes however, the mind remains clear to the last.

Death may result in a few minutes from asphyxia, or later from collapse.

If the patient recovers, the **resulting scars** which form in the oesophagus from the destruction of the tissues, may cause **narrowing (stricture) of the oesophagus.**

This causes severe symptoms on account of the lack of nourishment, from the inability to swallow food.

Treatment

1. Neutralize the ammonia with dilute acids, that do not harm the patient of themselves.

Vinegar and lemon juice are the best acids to use.

2. Protect the lining membrane of the oesophagus and stomach with milk, oils, albumin water and other protecting drinks.

3. Treat the collapse with heart stimulants such as caffeine, atropine, strychnine.

4. Do not keep the patient warm; as heat increases the action of ammonia. Apply cold applications to the head and give plenty of cold air.

5. If the patient suffers from asphyxia, the trachea must be opened (tracheotomy) to save the patient's life.

6. For the resulting narrowing (stenosis) of the oesophagus,

bougies must be passed, or surgical interference may be necessary.

Uses

Ammonia is used:

1. As a heart stimulant for temporary effect, for example in fainting.
2. In the form of liniments, to relieve pain.
3. To neutralize the acid of the gastric juice.
4. To check the formation of gas in the stomach.
5. To increase the cough and expectoration.

Preparations

Fluid Preparations

Strong Ammonia Water
(Aqua Ammoniae Fortior)

It contains about 28% of ammonia gas. It is never given internally. It is used locally, applied to snake bites and to form a blister to withdraw fluid from the deeper tissues.

Ammonia Water 0.6–2.0 c.c. m. x–xxx
(Aqua Ammoniae)

This contains 10% of ammonia gas.

Aromatic Spirit of Ammonia 2.0–4.0 c.c. ʒ½–i
(Spiritus Ammoniae Aromaticus)

This contains ammonia water and 4% of ammonium carbonate, together with the oil of nutmeg, oil of lemon and oil of lavender.

It is used principally to overcome fainting, as a carminative, and to relieve nausea.

Solution of Ammonium Acetate 4.0–16.0 c.c. ʒi–iv
(Liquor Ammonii Acetatis)
(Spirit of Mindererus)

This is used principally to increase sweating (diaphoretic) and to increase the flow of urine (diuretic).

For Local Use

Ammonia Liniment
(Linimentum Ammoniae)

This is a 3½% solution of ammonia in alcohol and cotton-seed oil.

Solid Preparations

Ammonium Carbonate (Ammonii Carbonas)	0.3–0.6 gm.	grs. v–x

This is used as a heart stimulant and as an expectorant.

Ammonium Chloride (Ammonii Chloridum)	0.3–1.3 gm.	grs. v–xx

This is used principally as an expectorant (see page 199).

There are numerous other salts of ammonium, such as ammonium bromide, ammonium iodide, etc. They are used principally for the effect of the bromide, iodide, etc. The combination with ammonium, however, makes them more strengthening to the heart.

The following drugs are used extensively as heart stimulants. Their general action will be considered later.

ATROPINE

Atropine makes the heart beat stronger and faster. It paralyzes the nerve endings in the heart, of the Vagus, or inhibitory nerves, which carry impulses to make the heart beat slower. When the nerve endings of these nerves are paralyzed, these impulses are cut off. The heart therefore beats stronger and faster. **The pulse, after atropine, is** therefore **stronger and faster.**

For other actions and preparations, see page 248.

STRYCHNINE

Strychnine makes the heart beat slower and stronger. It causes the medulla of the brain to send impulses along the Vagus, or inhibitory nerves to make the heart beat slower. It also contracts the blood vessels, and by thus offering greater resistance to the heart, makes the heart beat stronger. **The pulse is therefore slower and stronger after strychnine.**

For other actions and preparations, see page 273.

ALCOHOL

Alcoholic liquors make the heart beat stronger and faster. Because the blood vessels are widened (dilated) the pulse has a bounding quality; since the contractions and relaxations of the heart can be more easily transmitted along the wider blood vessels.

The pulse after alcohol is therefore strong, fast and bounding. The effects, however, last only for a very short time, usually for about an hour or two. For hypodermic use, whiskey is the preparation commonly used.

For other actions and preparations, see page 233.

MUSK

Musk is occasionally used as a heart stimulant. It is very expensive and very unreliable. When its effects *are* produced, it makes the heart beat stronger and faster. The pulse is therefore stronger and faster. The effects wear off very quickly.

For other actions and preparations, see page 456.

DRUGS ACTING ON THE BLOOD VESSELS

VASCULAR STIMULANTS

ADRENALIN

Adrenalin is an extract containing all the active principles, of the suprarenal or adrenal glands of the sheep or ox. The adrenal gland is a small triangular gland situated immediately above the kidney.

Appearance of the Patient

After an intravenous or hypodermic injection of adrenalin, the following effects are noticed within 15 or 20 minutes after it is given:

The skin becomes pale, all the visible mucous membranes, such as the lips and conjunctiva become pale and blanched. The pupils are dilated. There is an excessive secretion of saliva and mucous in the mouth.

The pulse is slow, strong, and very tense; the blood pressure being greatly increased; so that it is difficult to obliterate the pulse by pressure with the finger. The breathing is somewhat deeper. These effects wear off in an hour.

ACTION

Local action: Applied to the skin, it has no action. If applied to a bleeding point, it checks the bleeding by contracting the blood vessels. **On mucous membranes:** Adrenalin has a decided effect. It makes the mucous membranes pale and contracts them. This effect is produced by the marked contraction of the muscle fibers in the walls of the small blood vessels underneath the mucous membrane. These are also affected by direct application of adrenalin to the mucous membrane.

For example—if applied to the **conjunctiva of the eye,** adrenalin makes it pale, it widens the eyelids, dilates the pupils and slightly protrudes the eyeball. **In the nose:** It

makes the mucous membrane pale and contracted, and thereby widens the nasal cavities.

Internal Action

In the mouth: The lining membrane becomes pale and contracted.

Since adrenalin is an extract of a gland (an organ of the body), it is digested by the gastric juice of the stomach. It therefore produces no effect when given by the mouth.

To obtain its effects, it must be given either intravenously, intramuscularly or hypodermically.

Action after Absorption

When given intravenously, the effects appear in about five to ten minutes. When given intramuscularly or hypodermically, the effects appear within a half hour.

After absorption, adrenalin affects principally the heart, the blood vessels, the involuntary muscles, the pupils and secretory glands.

Action on the heart: The effect of adrenalin on the heart, is similar to that of digitalis. **Adrenalin makes the heart beat stronger and slower.**

The heart beats stronger, because the heart muscle is made to contract more vigorously. The systole, or contraction of the heart is greater, and the heart therefore expels more blood with each contraction.

It beats slower, because of the increased number of impulses sent to the heart from the medulla of the brain, along the Vagus, or inhibitory nerves, to the heart. These impulses make the heart beat slower. Since the heart beats slower, it has more time to dilate between each contraction, so that the period of relaxation or diastole of the heart, is increased. More blood then enters the heart during this period of relaxation, to be expelled by the succeeding greater contraction.

Action on the blood vessels: The most important action of adrenalin, is upon the small blood vessels. It contracts the small involuntary muscle fibers in the walls of the small

blood vessels. This makes these blood vessels narrower, which then helps to increase the pressure of the blood in the vessels (blood pressure). At the same time, the narrower vessels offer a greater resistance for the heart to overcome. It therefore also makes the heart beat stronger; increasing the strength of its contractions, or systoles.

The blood vessels in the abdomen are contracted most of all, while those in the lungs and brain are contracted least.

The total effect of adrenalin on the circulation is, therefore;

Slow, strong contractions of the heart with greatly increased blood pressure, which make **the pulse slow, strong, and very tense.**

Action on involuntary muscles: Adrenalin increases the contractions of the involuntary muscles of the uterus. Its blood vessels also are contracted, making it very anaemic.

The involuntary muscles of the **stomach** and **intestines** are **relaxed;** though the blood vessels in their walls are contracted. **Action on the Pupil:** The pupil of the eye is widened (dilated) by contraction of the radial fibers of the iris, or colored part of the eye.

Action on the secretory glands: The secretions of all the secretory glands, except the sweat glands and the pancreas, are increased by adrenalin. This effect is produced by making the nerve endings in the glands more sensitive to stimuli. As a result of this action, they receive more impulses, which make the glands secrete more profusely.

The salivary glands, the mucous glands in the mouth and throat, the lachrymal glands, and the liver, all secrete more profusely after adrenalin. It therefore increases the flow of saliva, mucous in the mouth, the flow of tears and bile.

The secretion of the sweat and pancreatic juice is not increased by adrenalin.

It often causes sugar in the urine (glycosuria). The effect of adrenalin wears off very quickly; usually in about 15 minutes to an hour.

Excretion

Adrenalin is mostly destroyed in the body. Part of it, however, is eliminated by the kidney in about an hour or two.

Poisonous Effects

Overdoses of adrenalin, cause the following symptoms:

1. Slow irregular pulse.
2. Pale, blanched skin.
3. Dilated pupils.

Still larger doses cause,

1. Rapid weak thready pulse.
2. Collapse: Pale cold moist skin, slow and shallow breathing, and dilated pupils.

A single overdose may cause such profound collapse, that death may result.

Uses

Adrenalin is used:

1. **To check bleeding** by contracting the bleeding vessels. It is only of value in bleeding from the small blood vessels. The bleeding may start up again, however, when the effect of the adrenalin wears off, because after the blood vessels are contracted, they soon dilate again.

In bleeding from the nose, the stomach, intestines, uterus and bladder, adrenalin is very valuable, if applied to the bleeding spot.

2. **As a heart stimulant,** especially where a rapid effect is desired. The effect soon wears off however.
3. Adrenalin is often used together with cocaine. The adrenalin, by contracting the blood vessels, lessens the absorption of the cocaine, which is then less apt to cause poisonous effects.
4. In the treatment of Addison's disease (tuberculosis or cancer of the adrenal glands). It then supplies the absent secretion of the adrenal glands.

Preparations

Dried Suprarenal Glands 0.25 gm. **grs. iv**
(Glandulae Suprarenales Siccae)

The powdered dried suprarenal glands of the sheep or ox.

Adrenalin Chloride Solution 0.3–1.0 c.c. m. v–xv

This is a 1–1000 solution of adrenalin chloride, the active principle of the suprarenal glands, in normal salt solution.

Adrenalin Inhalant

This is a 1–1000 solution of adrenalin chloride in oil.

Adrenalin Ointment

An ointment of adrenalin chloride 1–1000 in strength.

Adrenalin Suppositories

A 1–1000 solution of adrenalin chloride in cocoa butter.

Adrenalin Tablets

Each tablet contains 0.001 gm. (gr. $\frac{8}{200}$) of adrenalin borate. Each tablet when dissolved in 1.0 c.c. (m. xv) of water, makes a 1–1000 solution.

Adrenalin is the name given to the active principle of the suprarenal glands by one particular firm that has had this name patented. There are other preparations of adrenalin, made by other firms under various names, such as:

Epinephrine.
Adnephrin.
Suprarenalin.
Suprarenin.
Supracapsulin.

The preparations of these are the same as those of adrenalin. **L. Suprarenin Synthetic** is an artificial preparation of adrenalin.

Administration

Adrenalin is given intravenously, intramuscularly, or hypodermically. When it is given intravenously, it must be injected very slowly, to avoid poisonous effects.

For local effect, it is used in 1–15000 to 1–1000 solutions, preferably in oil.

Table of Cardiac Stimulants

Drugs acting rapidly. Suitable for immediate effect.	Drugs acting slowly. Suitable for continous effect.	Drugs causing a rapid pulse.	Drugs causing a slow pulse.	Drugs whose effects wear off quickly.
Caffeine	Digitalis	Caffeine	Digitalis	Caffeine
Strychnine	Strophantus	Atropine	Strychnine	Adrenalin
Atropine	Squills	Ammonium	Adrenalin	Ammonium
Camphor	Convallaria	Alcohol	Camphor	Alcohol
Adrenalin	Apocynum	Camphor	(sometimes)	Musk
Ammonium	Adonis Vernalis	(sometimes)	Strophantus	
Alcohol		Musk	Squills	
Digalen			Convallaria	
Digipuratum (ampoules)			Apocynum	
Musk			Adonis Vernalis	

CHAPTER IX

DRUGS ACTING ON THE RESPIRATORY ORGANS

RESPIRATORY STIMULANTS

THE RESPIRATION

Breathing is an act whereby the lungs regularly inhale and exhale air about 18–20 times a minute.

The mechanism of breathing consists of rhythmical alternate expansions and contractions of the lungs.

Respiration consists of two phases.

1. **Inspiration.**
2. **Expiration.**

The inspiration is the period during which the lung inhales air. It is caused by the downward movement of the diaphragm, and the separation of the ribs. This makes the chest larger, so that the lungs expand and inhale air.

The inspired air contains oxygen which fills up the air sacs of the lungs. The oxygen then enters the blood, by passing through the walls of the air sacs into the capillaries of the lungs. It is then carried to the tissues and organs of the body by the circulation of the blood.

The expiration is the period when the lungs exhale air. This is caused by the contraction of the diaphragm, which then moves upward, and the contractions of the intercostal muscles (the small muscles between the ribs).

As a result of the contractions of these muscles, the chest becomes narrower, the lungs therefore contract and expel the air which they contain.

The expired air contains carbon dioxide gas, and other waste products which have been brought to the lungs by the impure blood from the various tissues and organs of the body.

Breathing is an automatic act; that is, it occurs inde-

pendently of all the influences produced by the other activities of the body.

The most important part of the act of breathing, is the action of the diaphragm, a flat dome-shaped muscle separating the chest from the abdomen. The contractions of this muscle are controlled by impulses sent from a spot of gray matter in the medulla of the brain, along two nerves which go to this muscle, called the Phrenic nerves. This spot of gray matter is called the respiratory center. It is often called the vital center, because, when it ceases to send impulses for breathing, the patient dies.

Death by hanging, or by the garotte (a method for execution of criminals in Spain), is caused by the destruction of the respiratory center in the medulla of the brain.

The breathing can be modified, however, by impulses reaching the respiratory center along various nerves.

Impulses affecting the larynx or the bronchi, may reach the respiratory center of the medulla, along the Vagus or inhibitory nerves (which also send fibers to the larynx, bronchi and lungs).

These impulses may cause the respiratory center to send impulses which may increase the depth and frequency of breathing (reflex action). Impulses reaching this center from the skin, such as those produced by cold air, cold water, etc., also increase the depth and frequency of breathing.

Dyspnoea

When it is difficult for the patient to get air into his lungs, for example, when there is an obstruction to breathing; all the muscles attached to the chest, from the arms, neck and abdomen, contract. This makes the chest very much larger. The lungs therefore expand more than usual, so that the inspiration is very much deeper.

The contractions of the diaphragm and intercostal muscles, are also greater; thereby making the chest much smaller with each expiration, so that more air is exhaled.

Such difficult breathing is called **dyspnoea.**

It is often caused when there is no obstruction to breathing, but when the blood is very impure, and contains a great

deal of carbon dioxide gas. This increases the impulses for breathing sent out from the medulla of the brain, thereby making the breathing deeper and more labored.

Apnoea

When the breathing is so slow and shallow that the movements of the chest can hardly be seen, it is called **apnoea.**

Cyanosis

Cyanosis is a blue color of the skin. This is caused by the dark color of the blood in the superficial blood vessels. This dark color is due to the carbon dioxide and other waste matters which the blood contains. It usually results when the patient does not get enough oxygen into the lungs to purify the blood.

Coughing

Coughing is a violent expiration preceded by a deep inspiration. When a patient coughs, there is first a deep inspiration, followed by violent contractions of the abdominal muscles, which push the abdominal organs up against the diaphragm. The diaphragm then presses up against the lungs, and violently expels the air and secretions which they contain. The expiration is violent, because at the time when the expiration occurs, the larnyx is closed.

Coughing is a reflex act. It occurs when an object lodges in the larynx, when the bronchi are red and inflamed, or when they contain a great deal of secretion. These affect the nerve endings in the bronchi, which send impulses along the Vagus nerves to the respiratory center in the medulla. This center at once sends back impulses to cause violent expiratory contractions of the diaphragm, and coughing results.

Drugs affect the respiration in two ways.

1. Increasing the breathing: Stimulation.
2. Lessening the breathing: Depression.

Respiratory stimulation

When the respiration is stimulated, the breathing is usually deeper and faster. More air, and therefore more oxygen enters the lungs and then the blood.

Respiratory stimulation is produced in several ways.

1. By sending more impulses for breathing from the respiratory center of the medulla of the brain.

2. By causing redness, swelling and profuse secretion (irritation) of the mucous membrane of the bronchi, impulses are sent along the Vagus nerves to the respiratory center of the medulla. This center at once sends back impulses to make the breathing deeper and faster (reflex action).

3. By improving the condition of the blood, the medulla is supplied with better and purer nourishment. It is therefore better able to send out more impulses for breathing. The breathing is then deeper and faster. Tonics such as iron, often increase the breathing in this way.

RESPIRATORY STIMULANTS

The following drugs are used as respiratory stimulants. They make the breathing deeper and faster. They produce this effect by increasing the action of the respiratory center, so that more impulses for breathing are sent out from this center.

Their general action has already been considered, or will be considered later.

Respiratory Stimulants

Atropine
Caffeine
Camphor
Strychnine
Alcohol
Ammonia

They are principally used in the treatment of collapse.

Atropine is the best known respiratory stimulant.

Strychnine is often used to increase coughing.

Ammonia is given by inhalation, usually in fainting.

ASPIDOSPERMA OR QUEBRACHO (not official)

Aspidosperma or quebracho, is obtained from the bark of the **Aspidosperma quebracho blanco**, a South American tree.

Its active principles are six alkaloids;

Aspidospermine
Aspidospermatine
Aspidosamine
Quebrachine
Hypoquebrachine
Quebrachamine

ACTION

Local action: On the skin, it produces no effect. **On mucous membranes:** It causes redness and profuse secretion of mucus.

Internal Action

In the mouth: It has a bitter taste and it increases the flow of saliva.

In the stomach: It increases the secretion of mucous membrane of the stomach, and causes nausea and vomiting.

In the intestines: It increases the secretion of mucous membrane often causing diarrhoea.

Action after Absorption

Aspidosperma is absorbed from the stomach, and affects principally the respiration, the mucous membranes, and slightly the heart.

Action on the respiration: Aspidosperma makes the breathing deeper and quicker. It causes more impulses for breathing to be sent out, from the respiratory center of the medulla.

Action on mucous membranes: The secretions of all the mucous membranes are increased; especially the secretion of mucous membrane of the bronchi. This increases the expectoration.

The effect on the mucous membranes results from its action on the vomiting center in the medulla of the brain. It causes the center to send out more impulses for vomiting. Such vomiting is always accompanied by increased secretions of all the mucous membranes; tears, nasal secretions, saliva, etc.

Action on the heart: The contractions of the heart muscle are weakened by aspidosperma. The pulse may be rapid or slow, but the blood pressure is always lowered.

Action on the kidney: The secretion of urine is often increased.

Excretion

Aspidosperma is eliminated from the body by the kidneys and intestines; and when the vomiting is severe, in the vomited matter.

Poisonous Effects

Overdoses of aspidosperma cause the following symptoms.

1. Nausea and vomiting.
2. Diarrhoea.
3. Slow and shallow breathing.
4. Convulsions and paralyses.

Uses

Aspidosperma is used principally to relieve difficult breathing (dyspnoea), especially in asthma and emphysema.

Preparations

Fluidextract of Aspidosperma (Fluidextractum Aspirospermae)	1.0 –4.0 c.c.	m. xv–℥i
Extract of Aspidosperma (Extractum Aspidospermae)	0.06–0.2 gm.	grs. i –iii
Aspidospermine (a mixture of all the alkaloids)	0.001–0.002 gm.	gr. $\frac{1}{60}$–$\frac{1}{30}$

OXYGEN

Oxygen is a gas which forms 20% of ordinary air, and is necessary for the life of all animals. It is inhaled by the lungs with the inspired air. From the lungs, it enters the blood and combines with the haemoglobin of the red blood cells. These cells carry the oxygen to the various tissues and organs of the body, where it combines with some of the constituents of their cells, which are thus enabled to carry on their various activities.

ACTION

Local action: Oxygen is a very good antiseptic, since most bacteria are unable to live in an atmosphere of pure oxygen.

Internal Action

When pure oxygen gas is inhaled, it enters the plasma of the blood, from the air sacs of the lungs. Some of the oxygen combines with the haemoglobin, forming oxyhaemoglobin, while part of it circulates uncombined, in the plasma. The formation of a greater amount of haemoglobin, gives the blood a brighter color, and the skin then turns a brighter red color.

The improved condition of the blood **makes the breathing slower, and slows and strengthens the heart action.**

Uses

Oxygen is used in **Pneumonia,** when the patient is blue and cyanotic, because he is not able to get enough oxygen in his blood, because part of the lung is consolidated. The oxygen inhalations often relieve this blue color, and make the breathing easier.

Oxygen is also given in **potassium chlorate, and illuminating gas poisoning,** because these drugs combine with the haemoglobin of the blood, and prevent it from taking up oxygen from the lungs. The oxygen which is inhaled in these cases, enters the plasma in sufficient quantity to supply the tissues with nourishment until the haemoglobin is freed from the poisonous substance.

Administration

Oxygen should always be given continuously; inhaled through a mask from a tank alongside of the bed. The inhalations should be stopped when the symptoms disappear.

STIMULATING EXPECTORANTS

The following drugs are used principally for their effects on the lungs.

They are used to increase the expectoration and the coughing (violent expiration). This effect is produced by the profuse secretion of the mucous membrane of the bronchi which these drugs cause.

The excessive secretions of the bronchi, affect their nerve

endings, thereby sending impulses along the Vagus nerves to the respiratory center in the medulla. This center at once sends back impulses to markedly increase the breathing, which then cause violent expiratory effects or coughing (reflex action).

AMMONIUM CHLORIDE (AMMONII CHLORIDUM)

Ammonium chloride is an alkaline salt formed by the combination of ammonia and hydrochloric acid.

Appearance of the Patient

When ammonium chloride is given, the cough and expectoration is increased. The expectoration is more fluid in character. The pulse is somewhat stronger and more rapid, and the breathing is deeper.

ACTION

Local action: Applied to the skin, ammonium chloride is more soothing than other ammonia preparations. It makes the skin feel cool and lessens inflammation. **On mucous membranes:** It increases the secretions, and slightly increases the growth and nutrition of the cells of the mucous membrane.

Internal Action

In the mouth: It has an unpleasant nauseating taste. In large doses it often causes nausea and vomiting.

In the intestines: It increases the secretion of the mucous membrane, often causing frequent movements of the bowels.

Action after Absorption

Ammonium chloride is absorbed rapidly from the stomach. After absorption it affects principally the mucous membrane of the bronchi and other mucous membranes, and slightly, the liver, sweat glands and kidney.

Action on the lungs: Ammonium chloride increases the secretion of the mucous membrane of the bronchi, and makes the secretion more fluid in character.

The increased secretions also affect the nerve endings in the bronchi, so that impulses are sent to the respiratory center in the medulla. The center then sends back more impulses to cause violent expiratory efforts, and the cough is therefore increased by this reflex action. The secretions, becoming more fluid, are also more easily expectorated.

Action on the respiration: Ammonium chloride **makes the breathing deeper and faster,** not only by the reflex action from the lungs, but also by directly acting on the respiratory center itself.

Action on the secretory glands: The secretion of all the mucous membranes such as those of the stomach and intestines, are increased by ammonium chloride.

The secretion of the sweat, the saliva, and the bile are also increased.

Action on the heart: In large doses ammonium chloride **makes the heart beat stronger and faster.** The pulse is therefore stronger and faster.

Action on the kidney: Ammonium chloride increases the flow of urine.

Excretion

Ammonium chloride is partly changed to urea, a normal constituent of the urine. It is excreted by the kidney, partly as ammonium chloride, and as urea.

Poisonous Effects

Overdoses of ammonium chloride cause:

1. Nausea and vomiting.
2. Diarrhoea.
3. Bleeding from the mucous membranes.
4. Profound collapse.

Uses

Ammonium chloride is used to increase expectoration and coughing.

Preparations

Ammonium Chloride (Amonii Chloridum)	0.3–1.0 gm.	grs. v–xv

Troches of Ammonium Chloride
(Trochisci Amonii Chloridi)

Each contains about 0.1 gm. (grs. ii) of ammonium chloride with 0.25 gm. (grs. iv) of licorice extract, and some syrup of tolu.

Liquor Amonii Anisatus (Solution of Ammonia and Anise)

This is a German preparation consisting of

Oil of anise	1 part
Ammonia water	5 parts
Alcohol	24 parts

It is not official in this country, but it is extensively used, and is a very valuable preparation. It is an excellent stimulating expectorant and is given in doses of 0.6 to 2.0 gms. (m. x–xxx).

SENEGA (SNAKE ROOT)

Senega is obtained from the root of the **Polygala senega**, or **senega snake root**; a plant growing in the middle and southern United States.

The active principles are a special kind of glucosides called **saponins**, because they form soapy or frothy solutions, (digitonin, one of the inactive principles of digitalis is such a substance). The saponins found in senega are **senegin** and **polygalic acid.**

Appearance of the Patient

When any of the preparations of senega are given, the cough and expectoration are increased, and the patient has more frequent movements of the bowels.

ACTION

Local action: Applied locally senega is injurious to the tissues, because of the saponins which it contains. **On the skin,** it causes redness, warmth and itching, often causing pustules. **On the mucous membrane:** it causes marked

redness, swelling, and profuse secretion of mucus. For example—in the nose, it causes marked redness, sneezing, with profuse secretion of mucus. Redness of the conjunctiva with swelling and profuse secretion of tears and mucus, is often caused when it is applied locally to the eye. It may even cause inflammation when locally applied.

Internal Action

In the mouth: It has a harsh unpleasant taste, it causes redness and swelling of the lining membrane of the mouth with excessive secretion of saliva.

In the stomach: It causes marked redness, swelling and profuse secretion of the mucous membrane, which often results in nausea and vomiting.

In the intestines: The same effects on the mucous membrane cause frequent movements of the bowels.

Action after Absorption

On account of the nausea and vomiting which it produces, senega is not readily absorbed; part of it being excreted in the vomited matter.

When it is absorbed, it affects principally the mucous membrane of the bronchi, other mucous membranes and slightly the sweat glands and kidney.

Action on the lungs: Senega increases the secretion of the mucous membrane of the bronchi. The redness and swelling of the mucous membranes, which it also produces, reflexly cause increased coughing.

Action on the secretory glands: It increases the secretion of sweat and it also slightly increases the flow of urine.

Senega is said to increase the menstruation.

Poisonous Effects

Overdoses of senega cause,

1. Nausea and vomiting.
2. Profuse diarrhoea.
3. Collapse; rapid, weak thready pulse, slow shallow breathing, pale, cold moist skin, and dilated pupils.

Uses

Senega is not a very reliable drug. It is used principally as a stimulating expectorant and somewhat as a diuretic.

Preparations

Fluidextract of Senega (Fluidextractum Senegae)	0.6–1.0 c.c.	m. x–xv
Syrup of Senega (Syrupus Senegae)	4.0–8.0 c.c.	ʒi–ii

Senega is also contained in the compound syrup of squills.

QUILLAJA (SOAP BARK)

Quillaja, panama bark, or soap bark, is obtained from the inner bark of the **Quillaja saponaria,** a South American tree growing principally in Chili.

Its active principles are **saponins** (soapy or frothy glucosides) called, **quillaja sapotoxin,** and **quillajic acid.**

ACTION

Local action: Applied to the skin, it is very injurious. It causes redness, swelling and severe inflammation. **On mucous membranes:** It has the same effects and causes profuse secretion.

Internal Action

In the mouth: It has a harsh unpleasant taste. It inflames the mucous membrane.

In the stomach: It causes redness and swelling of the mucous membrane, producing in this way, nausea and vomiting.

In the intestines: It produces the same effect on the mucous membrane, which results in frequent movements of the bowels.

Action after Absorption

Quillaja is absorbed in the stomach.

After absorption, it affects principally the mucous membranes; especially the mucous membranes of the lungs.

Action on the lungs: Quillaja increases the secretion of the mucous membrane of the bronchi. In this way it also reflexly increases the cough.

Poisonous Effects

On account of the saponins which quillaja contains, large doses cause:

1. Nausea and vomiting.
2. Diarrhoea.
3. Collapse.

Large doses also paralyze muscles and nerves. Such doses weaken the contractions of the heart. Its action on the heart is directly antagonistic to that of digitalis.

Uses

Quillaja is occasionally used as an expectorant. It is used by pharmacists to emulsify (break up into fine globules) oils and other oily substances. It is largely used for cleaning silk and other fabrics.

Preparations

Fluidextract of Quillaja (Fluidextractum Quillajae)	0.2 c.c.	m. iii
Tincture of Quillaja (Tinctura Quillajae)	2.0–4.0 c.c.	$3\frac{1}{2}$–i

SAPONINS AND SAPOTOXINS

Saponins and Sapotoxins are a species of glucosides, which have the property of forming soapy or frothy solutions. They are thus able to hold substances which cannot be dissolved, suspended in finely divided particles in a fluid.

The more poisonous ones are called **sapotoxins**; the less poisonous ones **saponins.**

Senega and quillaja produce their effects because of the saponins which they contain.

ACTION

The saponins and sapotoxins are poisonous to all living tissues (protoplasm) by causing such markedly increased

activity, as to injure the tissues. Large doses of saponins or sapotoxins, or plants containing such glucosides, cause:

1. Violent vomiting.
2. Profuse diarrhoea.
3. Painful urination, often bloody urine.
4. Convulsions.
5. Often these glucosides cause destruction of the red blood corpuscles, so that the haemoglobin is set free in the serum (laking of the blood).
6. Collapse.

Saponins and sapotoxins are contained in about 150 kinds of plants. The most important ones are:

Polygala senega.

Quillaja saponaria.

Various kinds of smilax, such as sarsaparilla.

Agrostemma githago or corncockle.

Gypsophila struthium.

Of these, the only ones used in medicine to any extent are, **senega, quillaja,** and **sarsaparilla.** Senega and quillaja are used as expectorants and have already been described.

Sarsaparilla is used to improve the nutrition of the tissues and will be described later.

TEREBENUM (TEREBENE)

Terebene is a liquid formed from the oil of turpentine when it is acted upon by sulphuric acid.

The effects of terebene are similar to those of turpentine.

ACTION

Local action: Applied to the skin or mucous membranes, it causes redness and is somewhat antiseptic.

Internal Action

In the mouth: It has a rather pleasant odor and taste, and reddens the mucous membrane.

In the stomach and intestines: It acts as an antiseptic, and carminative. It checks the formation, and hastens the expulsion of gas.

Action after Absorption

Terebene is rapidly absorbed from the stomach. After absorption it affects principally the lungs and kidneys.

Action on the lungs: In the lungs it acts as an antiseptic. It is often inhaled for its antiseptic effect. It increases the secretion of mucus, thereby increasing expectoration and reflexly increasing coughing.

Action on the kidneys: Terebene increases the flow of urine (diuretic). It often relieves neuralgic pains.

It is excreted mainly by the urine.

Uses

Terebene is used principally as a stimulating expectorant. It is also used to expel gas from the stomach and intestines and as an antiseptic in inflammations of the kidneys and bladder.

Preparations

Terebene (**Terebenum**)	0.3–2.0 c.c.	m. v–xxx

TERPIN HYDRATE

Terpin hydrate is a colorless crystalline substance made from the oil of turpentine, by the action of nitric acid, alcohol and water.

Its action is similar to that of turpentine.

ACTION

Local action: Applied to the skin or mucous membranes, it causes redness.

Internal Action

In the mouth: It has an aromatic bitter taste.

In the stomach and intestines: It acts as an antiseptic and carminative. It checks the formation, and hastens the expulsion of gas.

Action after Absorption

Terpin hydrate is rapidly absorbed. It affects the mucous

membranes, especially the mucous membrane of the bronchi, and it also affects the kidneys.

Action on mucous membranes: It reddens and increases the secretions of all mucous membranes.

Action on the lungs: Terpin hydrate increases the secretions of the mucous membrane of the bronchi. In this way, it reflexly increases coughing. Expectoration is increased, because of the increased cough; and the secretions are looser.

Action on the kidney: It increases the flow of urine (diuretic action).

Terpin hydrate, like turpentine, often relieves neuralgic pains.

Excretion

It is excreted mainly by the kidney.

Uses

Terpin hydrate is used principally as a stimulating expectorant, as an antiseptic in gonorrhoea, and in cystitis (inflammation of the bladder).

Preparations

Terpin Hydrate (Terpini Hydras)	0.06–0.2 gm.	grs. i–iii

BALSAM OF PERU (BALSAMUM PERUVIANUM)

Balsam of Peru is a dark brown syrupy fluid, which does not dissolve in water. It is a balsam which oozes from the trunk of the **Toluifera pereirae**, a tree growing in Central America. (A balsam is an aromatic fluid, or semi-solid substance which exudes from a plant; for example, the sap of a tree is a balsam. Balsams consist of a volatile oil, a resin, benzoic and cinnamic acids.)

ACTION

Local action: Applied to the skin, it is somewhat antiseptic and soothing. **On wounds and ulcers** it hastens the heal-

ing by increasing the formation of new cells. **On mucous membranes:** It causes slight redness and it increases the secretions.

Internal Action

In the mouth: It has a warm bitter taste.

In the stomach and intestines: It increases the secretion of the mucous membrane; it is slightly antiseptic, and checks the formation and aids the expulsion of gas. (Carminative action.)

Action after Absorption

After absorption, it affects principally the mucous membrane of the bronchi, and slightly the heart and kidney.

Action on the lungs: Balsam of Peru increases the secretion of the mucous membrane of the bronchi, thereby aiding expectoration. The excessive secretion also reflexly increases the cough.

Action on the heart: The heart beats somewhat faster and stronger, so that the pulse is somewhat faster and stronger. This action is very slight, however.

Action on the kidneys: On account of the benzoic acid which the balsam contains, it slightly increases the flow of urine.

Excretion

Balsam of Peru is excreted rapidly by the kidneys.

Uses

Balsam of Peru is used principally to increase the growth of granulation tissue (young scar tissue). It is occasionally used as a stimulating expectorant.

Preparations

Balsam of Peru (Balsamum Peruvianum)	0.3–1.0 c.c.	m. v–xv

BALSAM OF TOLU (BALSAMUM TOLUTANUM)

Balsam of tolu is a reddish yellow sticky semi-solid substance, which dissolves in alcohol, but not in water.

It is a balsam obtained from the sap of the bark of the **Toluifera balsamum,** or **Myroxylon toluifera,** a Central American tree closely related to the tree from which the balsam of Peru is obtained.

The composition of both the balsam of tolu and the balsam of Peru is the same, except that the balsam of tolu contains more benzoic acid.

ACTION

The effects are similar to those produced by the balsam of Peru. Its odor, however, is very fragrant and it tastes like vanilla. For this reason, the balsam of tolu is preferred for internal use.

Uses

It is principally used as a stimulating expectorant usually combined with other expectorants. Its action, however, is not very marked, its use being principally that of a flavoring agent.

Preparations

Balsam of Tolu (Balsamum Tolutanum)	0.3–1.0 gm.	grs. v–xv
Syrup of Tolu (Syrupus Tolutanus)	2.0–4.0 c.c.	ʒ½–i
Tincture of Tolu (Tinctura Tolutana)	1.0–4.0 c.c.	m. xv–ʒi

Balsam of tolu is also contained in the compound tincture of benzoin.

TAR (PIX LIQUIDA)

Tar is a black semi-solid sticky substance of a peculiar characteristic odor and taste. It is an oleoresin. It is obtained by the destructive distillation of the wood of various species of the pine tree. The **Pinus palustris** or the pine tree of North Carolina is principally used. (Destructive distillation is a process of decomposition by heating. Some of the decomposed products are vapors, and become fluid or semi-solid when received in a cold receptacle.)

When tar is distilled, it forms the oil of tar, an oily liquid and a solid black residue called pitch.

Tar consists of a number of substances; the most important ones are: creosote, pyroligneous acid, wood alcohol, and a number of other compounds of carbon and hydrogen (hydrocarbons).

ACTION

Local action: Applied to the skin, tar is an antiseptic, and causes redness and slight swelling (mild irritation). **On mucous membranes:** It has an antiseptic action, causes redness and increases the secretion of mucus.

Internal Action

In the mouth: It has a peculiar, though not unpleasant taste and odor.

In the stomach: Tar causes redness, and profuse secretion of the mucous membrane, often causing nausea and vomiting.

In the intestines: It causes redness and profuse secretion of the mucous membrane; often causing frequent movements of the bowels. It is an antiseptic in the intestines and it often destroys worms.

Action after Absorption

Tar is absorbed from the stomach. After absorption it affects principally the lungs and the kidneys.

Action on the lungs: It increases the secretion of the mucous membrane of the bronchi, and in this way it reflexly increases the cough slightly. It is also an antiseptic in the lungs.

Action on the kidneys: Tar slightly increases the flow of urine.

Excretion

Tar is excreted mainly by the kidneys and intestines. It turns the urine and stools a very dark color.

Uses

Locally it is used in chronic skin diseases, especially in chronic eczema.

Internally it is principally used as a stimulating expectorant, especially in chronic bronchitis. It is occasionally used to destroy intestinal worms, and as an intestinal antiseptic.

Preparations

Oil of Tar (**Oleum Picis Liquidae**)	0.06–0.3 c.c.	m. i–v
Syrup of Tar (**Syrupus Picis Liquidae**)	4.0–12.0 c.c.,	ʒi–iii

This contains 7½% of tar.

Tar Ointment (**Unguentum Picis Liquidae**)

This contains 50% of tar.

ALLIUM (GARLIC) (not official)

Allium or garlic, is the bulb of **Allium sativum** or garlic plant. Its active principle is a volatile oil; the **oil of garlic.**

ACTION

Local action: Applied to the skin, it causes marked redness. **On mucous membranes:** It causes redness and profuse secretion.

Internal Action

In the mouth: It has a pungent, rather unpleasant taste and odor and it increases the flow of saliva.

In the stomach: It increases the secretion of gastric juice and aids digestion. **In the intestines:** The secretion of the mucous membrane is increased.

Action after Absorption

Allium is absorbed in the stomach, and affects principally the lungs, the mucous membranes, and slightly the heart.

Action on the lungs: In the lungs allium increases the secretion of the mucous membrane of the bronchi and air sacs; thereby also reflexly increasing the cough. It is said to increase the expulsive power of the very fine bronchioles.

Action on the mucous membranes: The secretions of all mucous membranes are increased by allium.

Action on the heart: It slightly increases the heart action.

Excretion

It is excreted mainly by the kidneys and the intestines.

Uses

Allium is used as a **local application** to cause redness of the chest, thereby withdrawing blood from deeper tissues (counter irritant). It is used for this purpose, especially in convulsions in children.

The garlic is chopped into fine pieces, and applied as a poultice. For infants, its strength is weakened with flaxseed meal.

Internally it is used as a stimulating expectorant in chronic bronchitis. It is given especially to children.

Preparations

Syrup of Garlic (Syrupus Allii)	4.0 c.c.	ʒi	(for a child)

SANGUINARIA (BLOOD ROOT)

Sanguinaria or blood root is obtained from the underground stems of the **Sanguinaria canadensis,** gathered in the autumn when its leaves are dead. Its active principle is an alkaloid **sanguinarine.** It was formerly used extensively as a stimulating expectorant, but it has now mostly been given up.

ACTION

Local action: Applied to the skin, sanguinaria relieves pain. **On mucous membranes:** It increases the secretion.

Internal Action

In the mouth: It increases the flow of saliva.

In the stomach and intestines: It greatly increases the secretion, causing vomiting, profuse diarrhoea with violent peristalsis.

Action after Absorption

After absorption, sanguinaria increases all the secretions; especially the secretion of the mucous membrane of the bronchi, the saliva and the flow of bile.

It also slows the pulse and it increases the blood pressure.

Poisonous Effects

Overdoses cause the following symptoms:

1. Violent vomiting.
2. Diarrhoea.
3. Great weakness.
4. Slow irregular pulse with low blood pressure.
5. Dilated pupils.
6. Collapse.
7. Convulsions; usually just preceding death.

Preparations

Tincture of Sanguinaria (Tinctura Sanguinariae)	1.0–2.0 c.c.	m. xv–xxx
Fluidextract of Sanguinaria (Fluidextractum Sanguinariae)	0.1–0.5 c.c.	m. ii –viii

ERIODICTYON (YERBA SANTA)

Eriodictyon is obtained from the leaves of the **Eriodictyon californicum,** or the California tar bush.

It is occasionally used as a stimulating expectorant in chronic bronchitis.

It lessens the appreciation of bitter tasting substances. It is often used as a vehicle in the form of an elixir, to disguise the taste of bitter drugs such as quinine.

Preparations

Fluidextract of Yerba Santa (Fluidextractum Eriodycti)	1.0–4.0 c.c.	m. xv–℥i

APOCODEIN HYDROCHLORIDE

(Not official)	0.06 gm.	gr. i

This is frequently used as an expectorant.

The following drugs are also frequently used as expectorants. Their action has already been considered, or will be considered later.

Squills
Benzoin
Eucalyptus
Turpentine
Prunus Virginiana (wild cherry)
Marrubium (horehound)
Serpentaria

CHAPTER X

DRUGS WHICH STIMULATE THE NERVOUS SYSTEM

THE NERVOUS SYSTEM

The nervous system, or the cerebro-spinal system, consists of a number of organs which regulate the activities of all the other organs and tissues of the body.

The nervous system increases or diminishes the activities of the various organs of the body. It harmonizes the actions of one organ with those of another, and the activity of the body with its surroundings.

The nervous system consists of the brain, the spinal cord, the nerves, and nerve endings.

The brain

The brain is an organ situated in the skull. It consists of an outer part which has numerous folds, called convolutions. This outer part is of a gray color and consists of numerous microscopic cells.

The inner part of the brain is white in color, and consists of numerous microscopic fibers coming from, or going to, the cells in the gray matter.

The cells of the gray matter are the active parts of the brain.

The brain is divided into three parts:

1. **The Cerebrum**
2. **The Cerebellum**
3. **The Medulla Oblongata**

The **cerebrum** forms the largest part of the brain and it is often called the fore brain.

The **cerebellum** is much smaller than the cerebrum, and is situated immediately behind the cerebrum. It is often called the hind brain.

The **medulla oblongata** joins the cerebrum to the spinal cord. It is often called the mid brain.

Action of the Cerebrum

The cells of the gray matter of the cerebrum do three kinds of work.

1. **Sensory**
2. **Motor**
3. **Mental**

The **sensory work** of the brain consists of receiving impulses or messages from the various organs of the body.

The **motor work** of the brain is to send out impulses or messages to the various organs of the body.

The **mental work** of the brain is to associate impulses and impressions, received, or sent out by one group of cells of the brain with those of another group.

SENSORY ACTIVITY OF THE BRAIN, OR THE IMPULSES OR MESSAGES THAT ARE RECEIVED BY THE BRAIN

The body is kept constantly aware of its surroundings, and objects about it, by the impulses received through its various senses.

There are five kinds of sensory impressions received by the brain. These impressions are received through the various senses:

1. **Sense of Sight**
2. **Sense of Hearing**
3. **Sense of Smell**
4. **Sense of Taste**
5. **Sense of Touch**

Sight

The impressions received through the sense of sight, are received through the eyes, which are complicated organs attached to the ends of nerves going to the brain; the optic nerves.

Through the eye the brain learns the character of various objects about it, their size, their shape and color. The body is thus able to avoid dangerous objects. It is also able to

distinguish between light and darkness, and in this way we can tell the time of day, etc.

Hearing

The impressions of hearing are received through the ears, by means of nerves going from the ears to the brain. Through the impulses of hearing, the body appreciates pleasant and unpleasant sounds. It is able to avoid dangers, and to respond to various impressions of sound; such as music, etc.

Smell

Through the sense of smell the brain is able to appreciate pleasant and unpleasant odors by means of nerves going from the nose to the brain; the olfactory nerves. Poisonous foods can thus be avoided, etc.

Taste

Through the sense of taste, pleasant and unpleasant food substances are recognized, by means of impulses sent from the tongue to the brain along various nerves. The enjoyment of food is thus helped, and poisonous foods can be avoided.

Touch

The brain receives impressions through the sense of touch by means of numerous nerves which reach it either directly or through the spinal cord. The impressions are received by numerous nerve endings scattered over every part of the skin, and then carried along the various nerves to the brain or spinal cord.

Four different kinds of impressions are received by the nerve endings in the skin. Many of these sensations are received by special nerve endings, and reach the brain or spinal cord by separate nerve fibers.

1. **Sensation of touch:** This is a sensation whereby the consistency and shape of an object is determined by feeling it; whether it is hard, soft, smooth or rough; whether it is round, square, etc.

2. **Sensation of pain:** This is an unpleasant sensation, whereby the body is able to avoid injurious objects, and by which we are made aware of various diseased conditions, such as inflammation, injuries, etc.

3. **Sensations of temperature:** This is a sensation whereby the brain is able to determine, whether an object is hot or cold, by means of impressions received by the brain from various nerves coming from special nerve endings in the skin.

4. **Muscular sense:** This is an important sensation whereby the brain is constantly informed of the position of the various joints of the body; such as the joints of the extremities. This enables us to walk about, without continually watching our steps, or to button our clothes without watching this act. In some diseases such as locomotor ataxia, where this sense is affected, the patient is unable to walk without watching his steps.

All the impressions received by the brain through the various senses are stored up in the cerebrum. When a similar impression is received again, it is at once recognized. For example—an object or color when seen again, is recognized as having been seen before, and under which circumstances it was seen.

MOTOR FUNCTIONS OF THE BRAIN

The impulses sent out from the brain are principally,

1. **Impulses for Motion**
2. **Impulses for Speech**

Impulses for Motion

Certain areas of the gray matter of the brain contain cells which constantly send out impulses to make the muscles contract, and thereby produce the various movements of the body. This part of the brain is called the **motor center.** There are two such centers; one on each side of the brain. Each side sends out impulses to cause motion of the opposite side of the body, and to regulate the movements of the extremities on that side of the body.

Impulses for Speech

There is an area of gray matter in the cerebrum, which sends out impulses to cause the complicated movements of the muscles of the larynx causing speech.

The speech center is situated only on one side of the brain, usually on the left side, except in left handed individuals, in whom it is situated on the right side.

MENTAL ACTIVITIES OF THE BRAIN

The following activities of the brain are called mental activities. They are not due to the action of any particular part of the brain, but to the action of a number of areas together, or by the action of one part of the brain upon another.

1. **Consciousness**
2. **Attention**
3. **Memory**
4. **Reasoning**
5. **Judgment**
6. **Emotion**
7. **Imagination**
8. **Will power**

Consciousness

By consciousness, we mean that we are aware of objects and persons about us, of the time of the day, of the place where we are, etc.

Consciousness depends upon our sensations; because the sensations inform the brain of our surroundings. When the sensations are increased, consciousness is increased; when they are diminished, consciousness is lessened. For example—morphine, a drug which lessens the appreciation of the sensations, produces unconsciousness, or sleep.

Attention

Attention is an activity whereby the brain keeps on receiving, sending out, and associating impulses only of one particular kind, at a certain time; that is, we are conscious only of a certain object. For example—when reading a certain book, we may have our attention so fixed on it, that

we may not see anyone coming into the room, nor objects about us. We may hear what anyone says, but yet not really know what was said.

Memory

Memory is an act of the brain whereby an old impression that has been received or sent out some time ago, either by our sensations or by our actions or experiences, is recalled again. For instance: We may remember that on a certain day we saw a famous parade. The impression of the parade is so fixed in our brain that it can easily be recalled.

Reasoning

Reasoning is an act of the brain whereby old impressions that have been stored up in the brain, either by experience or study, or received through our sensations, are combined to form a definite conclusion. For example—to find out the cost of ten apples when we know the cost of four. We have learned that we must first find the cost of one apple. This fact has been stored in our brain by study. We have also learned that ten is ten times one. By combining these two impressions, we find the cost of one apple by division, and then multiply the result by ten.

Judgment

Judgment is an act of the brain whereby we are able to determine the relation between the impressions that have been stored up in the brain as the result of either experience, of study or of impressions stored up, or occurring in the brain through our senses. For example—we have learned by experience, by our sensations, by study, or by all three, that certain acts are right and others wrong.

The foregoing mental activities of the brain are often called the **higher functions of the brain,** because they are usually an indication of the degree of intelligence of an individual.

Emotion

Emotion is an act, whereby the brain modifies the action of the body, the consciousness and the motor impulses sent

out from the brain. This results because of the expectation, knowledge and impressions previously received by the brain. For example—in watching an athletic contest, when our favorite team is successful, we shout, we laugh, we jump, we wave flags; in short, we are more active and more conscious. This is the result of the expectation under tension, of either the victory or defeat, and the effects of these, as learned by our previous experience.

The grief at the death of a friend or a relative, makes us less active, less conscious, less interested in objects about us, because of the impressions stored up in the brain as a result of the companionship of the deceased, and the contemplation of conditions due to his absence.

Emotions are of three kinds:

1. **Those causing pleasant sensations.** These emotions make the individual more satisfied; he is more active, more talkative, his spirits are brightened, he is gay, jolly and laughs easily.

The first example of the successful victory given above, is such an emotion. The most important pleasant emotions are joy and satisfaction.

2. **Those causing unpleasant sensations.** These emotions make the body less active. They often cause tremors of the muscles, crying, violent movements of the muscles or extremities the patient moving constantly about, loss of appetite, etc. The second example of the grief at the death of a friend is such an emotion.

The most common emotions of this kind, are **grief, anger, fear, remorse.**

3. **Complex emotions.** These consist of a mixture of the first and second groups of symptoms. These are often called the tender emotions. The most common ones are **sorrow, pity, gratitude, reverence, benevolence, love, sympathy.**

Imagination

Imagination is an act whereby the brain is conscious of objects that cannot be appreciated by the senses. The objects we imagine are really new combinations of old impressions that have been stored up in the brain by the sensa-

tions, such as sight, hearing, touch, etc.; by study, by reading or by experience.

Every new work of the imagination such as a novel, a play, an opera, etc., is really a new combination of events, impressions, and experiences, encountered by the author in his lifetime, or gained by reading or study. There is therefore, really "nothing new under the sun."

Will Power or Inhibition

Will power or inhibition is an act of the brain whereby all its activities, which have just been described, as well as all the activities of the spinal cord, are regulated, controlled or kept in check. This is one of the highest functions of the brain.

For example: We may have an experience which may increase one of our emotions such as grief. Yet we may not manifest this grief because our emotion may be controlled or inhibited by our will power.

One of the emotions such as anger, may be stimulated to such an extent, as to cause the brain to send out impulses to strike the individual who may be the cause of our anger. We do not strike him, however, because our emotions are kept in check by the inhibitory action of the brain or will power.

All the sensory, motor or mental activities of the brain when once performed, leave a record in the brain which may be revived at some future time.

ACTION OF THE CEREBELLUM

The cerebellum controls our equilibrium, that is, it regulates our movements in a straight line. It enables us to move forward, backwards, from side to side and up and down without staggering.

When the action of the cerebellum is disturbed, the patient usually staggers. If one side is affected, the patient usually staggers to one side.

ACTION OF THE MEDULLA OBLONGATA

The medulla oblongata joins the brain to the spinal cord. It consists of small areas of gray matter within, and white matter without. The areas of gray matter are called **centers.** Each center controls a certain action of the body, and constantly sends out impulses along certain nerves to cause or regulate these activities of the body.

Most of these activities are vital, because without them life cannot go on. The most important centers in the medulla are:

1. **The respiratory center,** which controls breathing.
2. **The cardio-accelerator center,** which makes the heart beat faster.
3. **The vagus or cardio-inhibitory center,** which makes the heart beat slower.
4. **The vaso-motor center,** which controls the width of the blood vessels.
5. **The vomiting center,** which sends out impulses to cause vomiting.

ACTION OF THE SPINAL CORD

The spinal cord is a long cord-like structure situated in the spinal canal, running from the skull to the sacrum. It has numerous nerves attached to it, which carry impulses to and from the cord.

The spinal cord consists of gray matter within, which contains all the cells, and white matter without, consisting of the fibers from these cells.

The function of the spinal cord is to cause an organ of the body to act, as a result of an impulse received from that organ, or from another part of the body by the spinal cord. Such an action, which depends upon an impulse received, is called a **reflex action.** (It is a reflected action, because it reflects the impulse received, by another impulse which is sent out.)

For example: When the bladder is full of urine, an impulse is sent from its inner wall to the spinal cord, which at once sends back an impulse to contract the muscles in the bladder; the urine is therefore expelled and the bladder is emptied.

When a hot object is applied to the skin of the arm, an impulse is at once sent to the spinal cord; which immediately sends out another impulse to make the muscles of the arm contract, and the arm is drawn away.

Reflex actions are controlled by the inhibitory or checking action of the brain.

For example: When the bladder is full, it is ordinarily prevented from emptying itself for a time. This is due to the inhibitory action of the brain which holds the reflex action in check.

THE NERVES

The nerves are bands of white fibers, which go to, and come from the brain and spinal cord.

The nerves that carry impulses to the brain and spinal cord, are called **sensory** or **afferent nerves.**

Those that carry impulses from the brain and spinal cord are called **efferent nerves.** The efferent nerves carry impulses to make the muscles contract, and to increase the secretion of the secretory glands.

The nerves end in the skin, the muscles, or the various organs of the body, by means of small bodies called **nerve endings.**

CONSCIOUS, SUBCONSCIOUS AND REFLEX ACTION

The activities of the nervous system are of three kinds.

1. **Conscious**
2. **Subconscious**
3. **Reflex**

Conscious actions are activities of the brain, of which we are aware. These actions occur only in the brain.

Subconscious actions are activities going on in the brain while we are conscious of something else. We usually, however, later become conscious of subconscious activities.

For example: While we are conversing about a certain topic, we wish to recall the name of a particular individual. We are unable to do so after considerable attempts, and we then give up the attempt. Some time later, while we are

occupied with another topic, the name suddenly occurs to us, and we remember the name we had been trying to find.

A process has been going on in the brain, without our being aware of it, which has brought back the memory of the name.

Reflex action is an activity which is the result of a stimulus received by the sensory nerves from the skin and other parts of the body.

Reflex actions may occur in the brain and spinal cord. In the spinal cord all the activities are reflex.

MODE OF ACTION OF THE NERVOUS SYSTEM

The action of the nervous system can be easily understood, if we compare it to a telephone system.

A telephone system consists of a central station, which receives all the messages from wires leading to, and coming from this central station. Messages are sent to the central station, by means of the transmitter, and they are received through the receiver.

The central station keeps all the subscribers in touch with one another. Some subscribers do not communicate directly with the central station, but by means of a sub-station, or a private switchboard. This sub-station must first be communicated with before reaching the central station or any of the subscribers connected to it.

The nervous system acts in a similar manner (see diagram).

The brain is the central station, which keeps the various organs of the body in communication with one another.

Some organs such as the eye, the ear and the nose, communicate directly with the brain, through the nerves which correspond to the wires of the telephone system. All the cranial nerves communicate directly with the brain through the nerves which correspond to the wires going directly to the central station.

The sensory nerve endings are the **transmitters** which send impulses along the sensory nerves to the central station, **the brain.**

The motor or **secretory nerve endings** are the **receivers** which receive impulses from the brain, the central station.

The spinal cord is the **sub-station** or switchboard.

Some parts of the body do not communicate directly with the brain, the central station, but through the spinal cord, which is the sub-station or switchboard. All the impulses from the skin of the trunk and extremities reach the brain in this way. All the impulses for motion reach the muscles of the extremities and trunk indirectly, through the spinal cord.

Just as an institution, having a private switchboard, can

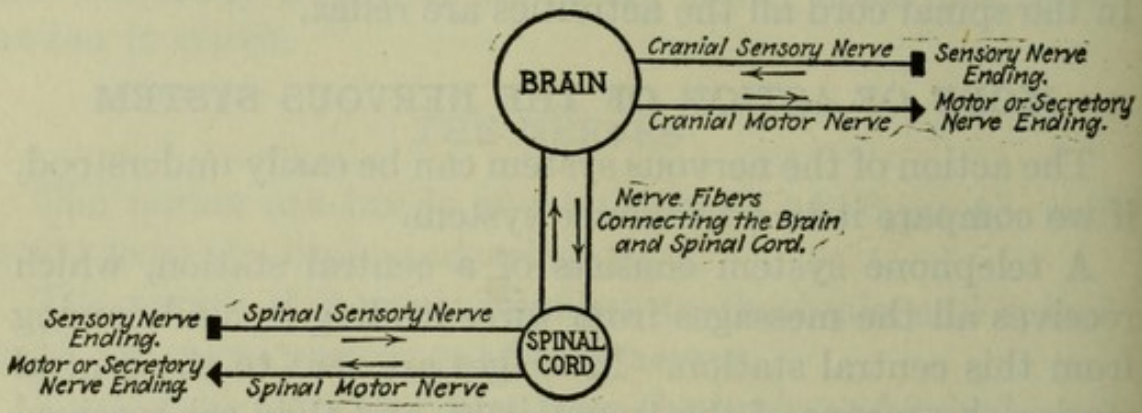

Diagram illustrating the action of the nervous system. The arrows indicate the direction in which the impulses travel

connect any of its individuals in one part of the building with other individuals in a different part of the building; so an impulse going to the spinal cord, may cause another impulse to be sent out from the spinal cord, without such an impulse being sent to, or coming from the brain. Such an action is a reflex action.

Mode of Action

For example: When an automobile is seen coming along the street at great speed, we at once get out of its way. The impulse received by the eye when the automobile is seen, is sent to the brain.

The brain then sends out impulses to the spinal cord, which in turn sends impulses to the muscles of the lower extremities causing them to contract. The legs are then moved and we get out of the way of the automobile.

The eyes are thus kept in communication with the muscles of the lower extremities.

Considering the nervous system as a telephone system, the message (the sight of the automobile) is sent to the

central station, the brain. This at once sends a message to the sub-station, the spinal cord, which in turn sends a message to the lower limbs, causing them to move.

EFFECTS OF DRUGS ON THE NERVOUS SYSTEM

Drugs affect the nervous system in two ways.

1. Increasing its activity, **stimulation.**
2. Lessening its activity, **depression.**

CEREBRAL STIMULATION

Drugs may increase the activity of the entire brain, or only of certain areas of it. In the latter case, only some of the activities of the brain are increased, while others may be normal or even diminished.

Stimulation of the Sensory Activities of the Brain

When the action of the areas of the brain which receive sensory impulses, is increased, the brain receives more impulses through the various senses. The patient is therefore brighter, wider awake, and he appreciates his surroundings better, that is, he is more conscious, because consciousness is the result of the sensations received through the various senses.

The patient appreciates all the various sensations better; such as the sense of pain, touch, heat, cold, etc.

Illusions and Hallucinations

When the various sensory areas of the brain are made very active, certain impressions which had been received through the various senses and stored up are revived. The patient then has sensations which do not exist. For example—stimulation of the area for receiving impulses of sight, makes the patient see objects that do not exist. Such impressions are called **hallucinations** or **illusions.** In this example they are **illusions** or **hallucinations of sight.**

If the area for the reception of sound is thus overstimulated, the patient may hear sounds, noises or voices, that do not exist. These are called **hallucinations of sound.**

If the area for the appreciation of the sense of touch is

over-stimulated, the patient may feel things that do not exist, such as objects or animals creeping over the skin. This often occurs in alcoholic delirium, or delirium tremens. These are called **hallucinations of touch.**

If the area of the brain which receives sensations of taste or smell is thus affected, the patient may taste or smell objects that do not exist. These are called **hallucinations** or **illusions of taste or smell.**

Stimulation of the Motor Areas of the Brain

When the areas of the brain which send out impulses for motion, are stimulated, the patient moves about more, and is more active, because of the greater number of impulses for motion which are sent out from the brain.

Convulsions

When the motor areas of the brain are over-stimulated, however, the impulses for motion are so strong, and so many, that instead of regular coördinated movements of the muscles, violent contractions, or convulsions result.

Convulsions are of two kinds: **Clonic** and **Tonic.**

Clonic convulsions are repeated single contractions of the muscles of the body.

Tonic convulsions are continual contractions of the muscles of the body. The muscles are then very stiff and rigid.

Stimulation of the Speech Center of the Brain

When the activity of the speech center of the brain is increased, the patient becomes more talkative.

Delirium

When the activity of the speech center of the brain is very greatly increased, for example: by drugs, or by the poisons of infectious diseases, all the impressions and memories for speech that have been stored up in the brain are sent out.

The patient talks continuously, of numerous objects that he has seen in the past, or sees at present. He may speak various words of different languages that he has heard at some time in his life, etc. This is called **delirium.**

The same causes which increase the activity of the speech center, also increase the activity of the motor areas of the brain. Delirium is often accompanied then, by excessive movements of the muscles and often by convulsions.

Stimulation of the Mental Functions of the Brain

Drugs which increase the activity of the brain also increase the mental activities of the brain. When these activities are increased, the patient is able to concentrate his mind better and pay closer attention. The reasoning and judgment are also increased and the memory is better.

When the imagination is increased, the patient is better able to combine old impressions into new ones. They may have visions of various objects, places and people. They may imagine new kinds of sounds.

Often the imagination is increased, while the activity of the sensory areas of the brain is lessened. The patient is then unconscious (asleep) but the increased activity of the imagination results in various dreams. Such effects are produced by morphine.

When the inhibitory action of the brain is increased, the patient is able to control the various activities of the brain and other organs better.

STIMULATION OF THE MEDULLA OBLONGATA

When the activity of the medulla of the brain is increased, the various centers which it contains become more active. If the respiratory center is stimulated, the breathing is deeper and faster.

If the **cardio-accelerator center** is made more active, the heart beats faster and stronger.

If the **vagus** or **cardio-inhibitory center** is increased in activity, the heart beats slower.

If the vaso-motor center is more active, the blood vessels become narrower, and the pulse is tense, and the blood pressure is greater.

If the vomiting center is made more active, the patient usually vomits frequently and profusely.

The entire medulla is rarely stimulated. Most drugs affect only certain centers in the medulla.

STIMULATION OF THE SPINAL CORD

When the spinal cord is made more active the patient is able to respond to all stimuli and impressions received by the senses, more rapidly and with greater force.

For example: When the spinal cord is stimulated, the application of a hot object to the hand will cause the arm to be forcibly drawn away, and may even cause convulsions, if the spinal cord is greatly stimulated.

Drugs which increase the activity of the spinal cord, such as strychnine, act as a tonic. This is due to the improvement, and greater activity of various organs of the body because of the increased reflex action. Such actions as breathing and movements of the bowels, which are reflex actions, or which are increased by reflex action, are improved.

STIMULATION OF THE NERVES AND NERVE ENDINGS

If the sensory nerves or nerve endings are made more active, the patient becomes more sensitive to pain, to heat and to cold. There may even be tingling in the areas of skin affected, a feeling as if there was some object creeping on the skin (formication).

If the efferent or motor nerves are thus affected, the patient may have twitchings of the muscles, if they are motor nerves or nerve endings. If they are secretory nerves or nerve endings, the glands supplied by these nerves secrete more profusely.

EFFECTS OF EXCESSIVE STIMULATION

When drugs increase the activity of the brain too much (over-stimulation), which often results from excessive doses of cerebral stimulants, the effects are those of lessened activity or **depression.**

The patient becomes less conscious, **falls asleep,** or becomes still more unconscious, and finally goes into a **stupor** (a deep sleep from which he can be awakened with difficulty). Later, **coma** develops (a deep sleep from which the patient cannot be aroused at all).

CEREBRAL DEPRESSION

Drugs may lessen the activity of the entire brain or only of certain areas of it. In the latter case, only some of the activities of the brain are lessened, while others may be normal or even increased.

Depression of Sensation

When the activity of the sensory areas of the brain are lessened, fewer sensory impulses reach the brain.

The sense of pain, touch, heat, cold, sight and hearing and all other sensations are lessened. Many drugs such as morphine, relieve pain in this way.

Since consciousness depends upon the sensory impulses received by the brain, when the reception of these impulses is lessened, the patient is less conscious, or may even be unconscious or asleep.

In overactivity of a cerebral depressant, stupor and coma result.

Motor Depression

When the action of the motor areas of the brain is lessened, fewer impulses for motion are sent out from the brain. The patient is then less active, he usually remains in one place without any desire to change his position.

Depression of the Speech Center

When the activity of the speech center is lessened, the patient is less talkative; and when he does speak, he is apt to speak slowly and in a low voice.

Depression of the Mental Functions of the Brain

Drugs which lessen the mental activities of the brain make the patient dull and stupid. He is unable to fix his attention or concentrate his mind on any subject, for any length of time. The reasoning is very slow and poor, the memory

is very poor and the patient is very forgetful. He is usually cold and unemotional.

When the inhibitory action or will power is lessened, the patient is unable to control the various activities of his brain and other parts of the body.

For example: Alcohol stimulates the speech center, but lessens the will power. It makes the patient talkative, but he often says things however, that may be foolish or improper.

DEPRESSION OF THE MEDULLA

Drugs which lessen the activity of the medulla usually lessen the action of its various centers.

When the action of the **respiratory center** is lessened, the breathing is slower and shallower.

Lessening the activity of the **cardio-accelerator center** lessens the impulses which make the heart beat faster, so that the heart then beats slower and weaker.

When the action of the **vagus** or **cardio-inhibitory center** is lessened, fewer impulses for slowing the heart reach it. The heart therefore beats faster.

When the activity of the **vaso-motor center** is lessened, the blood vessels become widened and the skin becomes flushed. The pulse is therefore softer and more bounding in quality.

DEPRESSION OF THE SPINAL CORD

When the activity of the spinal cord is lessened, the patient usually responds to stimuli less readily. In other words, the reflex action is lessened. It therefore lessens the activity of various organs of the body such as the movements of the bowels, breathing, etc., which are helped by reflex action or which act in a reflex manner.

DEPRESSION OF THE NERVES AND NERVE ENDINGS

When the activity of the **sensory nerves** or their nerve endings is lessened, the patient does not appreciate sensations

such as touch, temperature, pain, etc. It often produces numbness in the areas supplied by these nerves.

When the activity of the **efferent nerves** is lessened the results are:

Lessened contractions of the muscles if they are **motor nerves.** If the depression is very great, as in over activity of the drug, paralysis results.

Lessening the activity of the **secretory nerves** or their nerve endings, results in diminished secretion of these glands.

CEREBRAL STIMULANTS

ALCOHOL (ALCOHOL ETHYLICUM)

Alcohol is a colorless fluid which evaporates very quickly. It has a pungent odor, and a burning taste. It burns very easily with a blue flame, and it is often used for heating purposes.

Alcohol is obtained by the growth of the yeast plant, (a vegetable organism) in a solution of fruits or vegetables containing sugar. This process is called **fermentation.** Starchy fruits or vegetables also produce alcohol on fermentation, because the starch is changed to grape sugar, which is then fermented by the yeast.

The growth of the yeast plant changes the sugar to alcohol and carbon dioxide.

The fermented fluid is then heated in a large vat. Since the alcohol evaporates very easily, it turns to vapor when it is heated. The vapor then passes along a series of tubes into a cool receptacle, where the vaporized alcohol again becomes fluid. This process is called **distillation.**

Appearance of the Patient

After an ordinary dose of any alcoholic liquor, such as whiskey or wine, the patient usually becomes cheerful, is satisfied with himself, his surroundings, and those about him. He is perhaps more active and more talkative. The face is flushed, his eyes are bright. The pulse is rapid and bounding and the breathing is deeper.

ACTION

Local action: Applied to the skin, alcohol causes redness and itching. It hardens the skin, checks the sweat and acts as an antiseptic. Because it evaporates quickly, it makes the skin feel cold. If its evaporation is prevented, however, or if the skin surface is injured, it becomes red, painful and swollen (irritating).

On mucous membranes: It causes redness, swelling, a burning sensation and profuse secretion of mucus. It also hardens the cells of the mucous membrane.

Internal Action

In the mouth: It has a burning taste, it increases the flow of saliva, reddens and contracts the lining membrane of the mouth. Strong preparations, such as whiskey, often cause a burning sensation of the throat, and, on account of the fumes which it produces, it causes a fit of coughing, and a flow of tears from the eyes and nose.

In the stomach: Small quantities of alcoholic liquors aid the appetite, increase secretion of gastric juice, and also increase the peristaltic contractions of the stomach. The food is therefore digested better, and is passed into the intestines more rapidly for further digestion.

In the intestines: Alcoholic liquors increase the secretion of the mucous membrane and also increase the peristaltic contractions, thereby acting slightly as a laxative.

Action after Absorption

Alcohol is very rapidly absorbed, usually in about fifteen minutes. Most of it enters the blood through the lining membrane of the stomach, but a small part passes through the mucous membrane of the intestines.

After entering the blood, alcohol affects principally the circulation, the respiration, and the brain.

Action on the Circulation

On the heart: Alcohol makes the heart beat stronger and

faster. **On the blood vessels:** The blood vessels, particularly of the skin, are all widened by alcohol. As a result of this action the skin is flushed and the patient feels warm after taking alcoholic liquor.

The total effect of alcohol on the circulation, is **to make the heart beat stronger and faster and to widen (dilate) the blood vessels.**

The pulse is therefore strong, fast and bounding. The bounding quality is due to the dilated blood vessels, which allow the contractions and dilatations of the heart to be more easily transmitted to the blood vessels.

The effect of alcohol on the circulation lasts only for a short time; about an hour or two.

Action on the respiration: Alcohol makes the breathing deeper and faster.

Action on the brain: Alcohol increases some of the activities of the brain, but lessens other activities, such as the will power or inhibitory power, and judgment. It also slightly lessens the sense of pain.

The patient becomes self-confident in his own powers, often over confident. He thinks more quickly, is more active, he moves about more energetically. He is more talkative, but is not as careful as usual of his speech. He feels happier, jollier, and somewhat more emotional.

This increased activity is due to a greater number of impulses for motion sent out from the brain. The talkativeness, to increased impulses sent from the speech center in the brain. The emotions are made more active, as a result of which the patient is happy and jolly.

The will power and judgment, however, are lessened; so that the activity of the brain, while it is greater, is not controlled. While the patient is more talkative, he is not as careful of his speech. The jollity and laughter may be more boisterous than usual. The patient may be more emotional; but his emotions are not of the higher, more refined type of emotion, that result from control; but are rather crude and coarse.

Since the control of the will power over the activity of the brain is lessened, the stimulation of the other centers of the

brain is even greater; because their action is not controlled by the checking or inhibitory influences of the will power.

Effect on temperature: Alcohol lowers the temperature because the widening of the vessels of the skin makes the body lose heat.

Effect of nutrition: Alcohol has a distinct food value. About 90% of the alcohol taken is used up in the body. It combines with oxygen and is changed to carbon dioxide and water. In this way it gives up a great deal of energy for the activity of the cells of the body. It is able, therefore, to take the place of such foods as carbohydrates (starches, sugars) and fats.

It is only suitable for temporary use, however, as in fevers, because if given for a long time, alcohol injures the various organs and tissues of the body. This may neutralize any effect it may have as a food.

Action on the kidneys: Alcohol slightly increases the flow of urine.

Excretion

About 90% of the alcohol taken is used up in the body. The rest is rapidly eliminated by the kidneys, the lungs, and the skin, in the urine, the expired air, and the sweat.

Poisonous Effects

Acute alcoholic poisoning results from drinking alcoholic liquors to excess; and produces the familiar and far too common picture of drunkenness.

Symptoms

Large quantities of alcoholic liquors usually cause **marked excitement.** The individual is quite **talkative, active and moves about.** He is usually **jolly, boisterous, and often quarrelsome.** The face is flushed, **the pulse is strong, rapid, and bounding, the breathing is somewhat faster and the eyes are bright.** The excitement is often increased by the brilliant surroundings in which alcoholic liquors are usually indulged. The thoughts flow freely, perhaps too freely. The speech may be brilliant, but is loud, and the individual is not at all

careful of what he says. Even the words may not be spoken distinctly. This is due to the lack of controlling influences over the speech center, and its increased activity as a result of the alcohol.

The patient moves about, but his movements are undignified and he may even be **unsteady in his gait and stagger,** because the movements are not controlled by the will power.

The emotions too, are increased. There may be **sudden outbursts of anger, he may become quite sentimental and sensual.** This is due to the lack of control by the inhibitory or checking influence of the will power. The emotions, therefore, lack their finer restraining qualities.

The anger may be unreasonable and the sentiments are coarse, and there may be base sensual ideas.

The lessening of the will power and judgment is marked, too, in the disregard for conventionalities and for the feelings of others that drunken individuals usually have.

All these effects are due not alone to the increased activities of the various centers of the brain, but to lessening the activity of the will power, which is unable to check or regulate the activity of the brain.

When still larger quantities of alcoholic liquors are taken, there is marked nausea and vomiting, the staggering gait is very marked. The over activity of the brain finally exhausts it, and the individual then has symptoms of lessened activity or depression. **He falls into a deep sleep (stupor),** and becomes unconscious. All his sensations are diminished, and the reflex action is lessened. The face looks pale and is often blue or cyanosed, the breathing becomes slow and snoring in character (stertorous). The pulse is usually strong and bounding. In this stage the patient may lose control of his bladder or rectum.

With larger doses of alcoholic liquors, this condition may gradually grow worse, **the patient goes into coma, the breathing is very slow and shallow,** the pulse becomes rapid and weak and death may result from failure of the respiration.

Usually, however, the effects wear off in a few hours, the stupor gradually wears off and the patient gradually becomes conscious.

The effects of overdoses of alcohol vary with different individuals. Some become sentimental, others quarrelsome, and still others fall asleep and have no excitement stage at all.

When alcoholic liquors are taken in company, amidst brilliant surroundings, it is more apt to cause excitement.

Fatal results have occurred from a dose of 200 c.c. (1 pint) of whiskey.

Treatment

1. Wash out the stomach.
2. Give artificial respiration if the breathing is slow and shallow.
3. Apply cold applications to the head.
4. Keep the patient warm.
5. Give stimulants; such as ammonia, strychnine, etc.

CHRONIC ALCOHOL POISONING, OR "ALCOHOLISM"

Chronic alcohol poisoning results from habitually taking alcoholic liquors, especially distilled liquors, such as whiskey, gin, etc., because these contain large quantities of alcohol. Rarely, these symptoms result from habitually drinking beers or wines.

The injurious effect of alcohol is due to the fact that, if it is taken habitually, it dissolves some of the substances in the functionating cells of the various organs of the body. As a result of this, many of these cells are destroyed, and their place is taken by connective tissue; which is not an active part of an organ. The organ thus affected is then not able to perform its work as well as before, and the patient suffers from various symptoms as a result of it.

The organs usually affected are the stomach, the liver, the blood vessels, the nervous system, and the kidneys.

The stomach is affected by habitual alcoholism, so that many of the cells of its lining membrane are destroyed, their place being taken by connective tissue, and chronic gastritis results. The result of this is that the stomach

secretes less gastric juice, and the patient suffers from various digestive disturbances.

The secretion of mucus from the stomach is increased, the patient's tongue is dry and brown, the lips are red, and he usually complains of pain in the region of the stomach. Often he has nausea and vomiting in the morning.

The liver is often similarly affected. Some of its cells being destroyed, and replaced by connective tissue, a condition known as cirrhosis of the liver results. This makes the liver very hard and interferes with its circulation. The patient then often develops fluid in the abdomen from accumulation of the blood in the abdominal vessels. Digestive disturbances also result from this condition.

The blood vessels become thickened by habitual alcoholism, because there is more connective tissue formed in their walls. This condition is known as **arteriosclerosis.** The patient then suffers from various symptoms as a result of the disturbed circulation in various organs. The blood pressure is very high, the patients have headaches, and numerous other symptoms.

The heart may also be affected by alcohol, so that numerous areas of connective tissue may be formed in it. Disturbed heart action, often weakened heart action (myocardial insufficiency) may result.

The kidneys, too, are very frequently affected by habitual alcoholism, connective tissue replacing the cells which have been destroyed. The patient then suffers from chronic nephritis (Bright's disease). Small quantities of urine are passed. There may be oedema of the extremities, fluid in the tissues, etc.

Alcohol is particularly injurious to the nervous system. It destroys many of the cells of the gray matter of the brain. It is an important predisposing factor, often the cause, of various forms of insanity, of paralyses, etc.

The nerves are also affected by alcohol. Paralysis of the muscles of the arms and legs often results from the effects of habitual alcoholism (alcoholic multiple neuritis).

Other evidences of chronic alcoholism are a red nodular nose, dilated blood vessels of the skin, especially on the face,

and waxy, dry, soft skin. The mind is often sluggish and weak.

DELIRIUM TREMENS

This is a special kind of temporary alcoholic insanity. which occurs in habitual drinkers, when they receive any shock, such as from an injury, or haemorrhage, when they suffer from an infectious disease, or when they have undergone a surgical operation.

The symptoms are due to the patient being deprived of his usual amount of alcohol.

The symptoms are: **hallucinations of the various senses, abnormal fear, tremors of the muscles and excitement.**

The patient often sees various animals such as snakes, rats, dogs, etc., before him (hallucinations of sight) or he feels them creeping upon him (hallucinations of touch). Often he hears voices and is constantly talking to those who seem to be speaking to him. The patient usually has trembling of the muscles of the extremities and is afraid of everybody about him.

This condition usually disappears, if alcoholic liquors are given. It can be avoided if alcohol is given regularly to those patients who take it habitually, whenever they are subject to any shock, or when they have undergone a surgical operation.

Uses

Locally, alcohol is used:

1. To harden the skin and prevent bed sores.
2. As an antiseptic; 50% alcohol is the best preparation for antiseptic use.

Internally, alcohol is used:

1. As a cardiac and respiratory stimulant in cases of shock and collapse. Whiskey and brandy are usually used for this purpose.
2. In cases of sudden chill, whiskey or brandy in hot water, relieves the congestion of the internal organs, by widening the vessels of the skin.

3. In acute infectious diseases, such as typhoid, septicaemia, pyaemia, etc.

In these cases it not only acts as a food, but it helps to increase the resistance of the body against the infectious agent, so that the body is better able to overcome the infection. In such cases, the pulse will become slower, the temperature is lowered, the breathing becomes slower and deeper. The delirium and other nervous symptoms are lessened, and sleep is induced. The tongue becomes moist and the skin perspires more profusely.

When these effects are produced, alcohol is acting favorably.

When, however, alcohol causes a full, rapid, strong, bounding pulse; the delirium, restlessness, uneasiness, and other nervous symptoms, are increased; the sleeplessness increases and the tongue and the skin remain dry, the alcohol is acting unfavorably, and it should be stopped.

4. In poisonous snake bite, alcohol, in the form of whiskey or brandy, should be given in very large doses.

5. In some individuals, alcohol may be used as a hypnotic. Beer, brandy, or whiskey and water, may be used for this purpose.

6. Brandy occasionally checks diarrhoea.

7. Dilute alcohol is a very valuable antidote in carbolic acid poisoning.

Tolerance

Individuals who take alcoholic beverages habitually, can take large quantities of alcohol without any of the usual symptoms being produced. This condition is known as tolerance for alcohol. To obtain effects in such individuals, much larger doses than usual must be given, often even more than twice the usual dose.

Administration

For local use the preparations of alcohol are used.

For internal use alcoholic liquors are principally used.

For temporary use and for immediate effects the distilled liquors, such as whiskey or brandy, are the best.

For immediate effect they are best given hot, and not diluted very much. Ordinarily, brandy or whiskey are best given diluted in a small glass, full of cracked ice, very often in vichy or seltzer, or with milk and egg in the form of a **milk punch** or **egg nogg.**

In collapse brandy and whiskey are frequently given hypodermically.

For continued use the fermented liquors such as wine or beer are used.

Preparations

For local use

Alcohol
(Alcohol)

This contains 95% of ethyl alcohol by volume, and 92% by weight. It is used for rubbing the skin, to prevent bed sores, and for burning.

Absolute alcohol
(Alcohol absolutum)

This contains 99% of ethyl alcohol. It is not ordinarily used, except by pharmacists and in laboratories.

Dilute alcohol
(Alcohol dilutum)

This contains about 50% of ethyl alcohol by volume and about 41% by weight. This is the best preparation to use for antiseptic use.

For internal use

Alcoholic Beverages

Distilled liquors

Whiskey 15.0 c.c. ℥ss
(Spiritus Frumenti)

This contains about 44 to 50% of ethyl alcohol by weight, and about 50 to 56% by volume. Whiskey is made by distilling fermented grain or other starchy plants. It should

be at least four years old, because the fresh preparations are too injurious to the tissues.

There are several kinds of whiskey.

American whiskey, made by distilling fermented rye and corn.

Scotch whiskey, made by distilling fermented barley.

Irish whiskey, made by distilling fermented potatoes.

Brandy or Cognac (Spiritus Vini Gallici) 15.0 c.c. ℥ss

This contains about the same percentage of alcohol as in whiskey. Brandy is made by distilling fermented unchanged juice of fresh grapes. It should be at least four years old, because the fresh preparations are injurious to the tissues. There are two kinds of brandy, pale and dark. The dark brandy contains caramel.

Brandy or cognac contains small quantities of tannin. As a result of this, it has a tendency to contract mucous membranes. It is therefore more soothing to the stomach and intestines, and has a tendency to constipate and check diarrhoea.

Rum (not official) 15.0 c.c. ℥ss

Rum contains the same percentage of alcohol as whiskey. It is made by distilling fermented molasses.

Gin (not official) 15.0 c.c. ℥ss

Gin contains about the same percentage of alcohol as whiskey. It is made by distilling fermented rye, or barley, and flavored with juniper berries. Because of the juniper which it contains, gin increases the flow of urine (diuretic).

Fermented Liquors

Wines

Wines are fermented liquors, made from grapes. Besides the alcohol, wines contain various acids such as tartaric and tannic acids, and some volatile oils.

There are several kinds of wines:

White wines.
Red wines.

Of these, there are several kinds:

Dry wines.
Sweet wines.
Sparkling wines.

White Wines (Vinum Album)

White wines are made by fermenting grapes without the skins, stems or seeds. They contain 7 to 12% of alcohol.

Dry wines are those which contain no added sugar.

Sweet wines are those which contain sugar which has been added.

Sparkling wines are those which are bottled before fermentation is complete. They contain carbon dioxide gas, and effervesce.

The most important white wines are:

Dry white wines, such as rhine wines. They contain about 10% of alcohol.

Sweet white wines, such as tokay wines. These contain about 14% of alcohol.

Sparkling white wines, the most commonly used sparkling white wine is **champagne,** which is a French white wine. It contains about 10% of alcohol.

Champagne should be given ice cold, in teaspoonful doses. It is particularly valuable in cases of nausea and vomiting, for example, after an operation.

Champagne is not so effective when the gas escapes. To avoid this, a special tap is inserted in the cork, and the bottle should be kept on ice, upside down.

Red Wines (Vinum Rubrum)

Red wines are made by fermenting colored grapes with the skins. They contain larger amounts of alcohol than the white wines.

Dry Red Wines:

Claret

This contains about 8–10% of alcohol.

Sherry (Vinum Xericum)

Sherry contains about 15–20% of alcohol and is often made artificially.

Port Wine (Vinum Portense)

This is the strongest red wine, and contains about 20–40% of alcohol.

Sweet Red Wines: The most common sweet red wines used are burgundy and madeira. They contain from 6–20% of alcohol.

Sparkling Red Wines: The most common sparkling red wine is **sparkling burgundy,** which contains about 10% of alcohol.

Uses of Wines

The wines are not as stimulating as the distilled liquors, such as whiskey or brandy. They are, however, better suited for continued use. They aid digestion when taken during meals. Sweet wines, however are apt to disturb digestion.

The wines contain tannic acid and contract mucous membranes (astringent action). They are therefore more constipating than the distilled liquors.

Sparkling wines, such as champagne, are soothing to the stomach when given in small doses. They are not as stimulating to the heart. Champagne causes intoxication easily, in spite of the small quantities of alcohol which it contains. When taken in larger quantities it is apt to cause headache, pains in the stomach, nausea, hiccough, etc.

Beers

Beers are made by fermenting starchy grains. They are usually made by fermenting brewed barley malt (barley which has begun to grow and the growth stopped), with hops.

Ale, porter and **stout,** are the various kinds of beers that are used. They contain about 3–10% of alcohol with a large amount of solids, mainly sugar and starches. Because of the starches and sugar which they contain, beers are very nutritious. They occasionally disturb digestion however.

Liqueurs are preparations of volatile oils containing alcohol. Many of them contain sugars. One of them (kirchwasser) contains very small quantities of hydrocyanic acid.

Various essences of flowers, such as eau de cologne, contain large amounts of alcohol. Cases of alcoholism occasionally occur in women from drinking eau de cologne.

WOOD ALCOHOL (METHYL ALCOHOL)

Wood alcohol is made by the destructive distillation of wood. It is very inflammable, and because of its cheapness it is used to dissolve various substances.

Wood Alcohol is a Distinct Poison

A single overdose causes the following symptoms:

1. Nausea.
2. Vomiting.
3. Great muscular weakness.
4. Weak pulse.
5. Violent delirium.
6. Coma.

A number of cases of death have occurred from a single overdose of wood alcohol.

Chronic Wood Alcohol Poisoning

If wood alcohol is taken either internally, or applied externally for a long time, blindness may result from destruction of the optic nerve (optic nerve atrophy).

Unfortunately, wood alcohol is too commonly used by unscrupulous manufacturers, in the manufacture of various essences such as soda water flavors, jamaica ginger, witch hazel, bay rum, cologne, etc. Many patent medicines, such as peruna and others, contain wood alcohol.

The use of all preparations of wood alcohol should be avoided; both for internal and external use. They are very apt to result in blindness or other dangerous symptoms.

There are numerous other alcohols such as propyl alcohol, butyl alcohol, amyl alcohol, etc., which result in the distillation of ordinary wood alcohol.

Amyl alcohol, or fusel oil, is very injurious when applied locally. It is often present in freshly distilled preparations of whiskey.

ATROPINE GROUP OF DRUGS

The following group of drugs produce similar effects because they contain the same active principles.

The active principles occurring in these plants are the alkaloids:

Atropine
Hyoscyamine
Hyoscine

and sometimes atropamine and belladonine.

All these alkaloids are closely related to one another, and some of them are compounds of still simpler alkaloids.

Atropine is really a strong compound of a still simpler alkaloid, **tropine,** with **tropic acid.**

By decomposing atropine and combining another acid with the tropine, artificial alkaloids are formed. **Homatropine,** for example, is a compound of tropine with another acid (oxytoluic acid).

Hyoscyamine has the same chemical composition as atropine. There is very little difference between them.

Hyoscine or **scopolamine** is closely related to atropine. It consists of scopoline or oscine, an alkaloid combined with tropic acid.

The drugs which contain these alkaloids all belong to the group of plants known as the **Solanaceae.** (The potato and egg plants also belong to the same group.)

The most important plants of this group are:

Atropa Belladonna (Deadly Nightshade)

This contains **atropine, hyoscyamine,** and **hyoscine** and small quantities of atropamine and belladonine.

Hyoscyamus Niger (Henbane)

This contains **hyoscyamine, hyoscine,** and small quantities of **atropine.**

Datura Stramonium (Thornapple)

This contains **atropine, hyoscyamine** and some **hyoscine.**

Other less important plants of this group are:

Duboisa Myoporoides

This contains **hyoscine** and **hyoscyamine** and several other alkaloids.

Another species of this plant contains an alkaloid piturine, which is closely allied to nicotine.

Scopola Atropoides

This contains **hyoscyamine** and **hyoscine,** with small quantities of **atropine.**

Mandragora Autumnalis or Atropa Mandragora (Mandrake)

This contains **hyoscyamine,** with traces of other alkaloids.

Potato leaves and tobacco leaves, which belong to the same group of plants, also contain very small quantities of one or a number of these alkaloids.

BELLADONNA AND ATROPINE

Belladonna is a drug obtained from the leaves and roots of the **Atropa belladonna** or **deadly nightshade.** It is a perennial plant, about three feet high, which ordinarily grows in England and other parts of Europe, but it has also been cultivated in this country.

The active principles of belladonna are the alkaloids:

Atropine
Hyoscyamine
Hyoscine

Sometimes atropamine and belladonnine also occur.

The effects of belladonna are due to the atropine which it contains. This is preferred for internal use.

Appearance of the Patient

After administration of atropine, or one of the atropine

containing drugs, such as belladonna or hyoscyamus, the following effects are produced within ten minutes to a half hour.

The patient looks brighter, the face and neck are somewhat flushed, and the pupils are dilated. He is more wakeful, restless, more active and talkative.

The pulse is rapid and strong and the breathing is deeper and faster. Various cramp-like pains, such as pains in the stomach, intestines, or bladder, from which the patient may be suffering, are relieved.

The patient complains of dryness of the mouth and throat and because of this he complains of thirst. The skin usually feels dry, and may be quite red.

If the patient has an attack of shortness of breath, it is usually relieved by atropine.

ACTION

Local action: On the skin, atropine relieves pain, and checks the secretion of sweat. This effect is produced by paralyzing the sensory nerve endings in the skin. It is often used for this purpose in the form of a belladonna plaster. Atropine or belladonna is readily absorbed from the skin if applied in a solution of alcohol, glycerine, or camphor, or in the form of a plaster. It often causes general effects or even poisonous symptoms from such applications. **On mucous membranes:** Atropine checks the secretion.

Internal Action

In the mouth: Atropine has a bitter burning taste, and checks the secretion of saliva and mucous. It makes the mouth and throat feel dry.

In the stomach: The secretion of gastric juice is lessened, and the digestion of food is therefore retarded. The peristalsis of the stomach is also greatly lessened by atropine.

In the intestines: Atropine checks the secretion of the mucous membrane of the intestines and lessens the peristaltic contractions of its muscle wall. It is often used for this purpose to check the griping pains of cathartics.

Action after Absorption

Atropine enters the blood through the mucous membrane of the stomach. It is rapidly absorbed, usually within a half to one hour. After absorption, it is carried by the circulation of the blood to various organs of the body; but it affects principally the heart, the respiration, the brain, all the secretory glands, the involuntary muscles and the pupil.

Action on the heart: Atropine makes the heart beat faster and stronger. The systoles, or periods of contraction of the heart are increased, while the diastoles or periods of relaxation are lessened. The heart then expels more blood and with greater force.

This effect is produced by atropine paralyzing the nerve endings in the heart, of the Vagus or inhibitory nerves. The checking or slowing influence is then taken away from the heart, so that no impulses reach the heart, to make it beat slower.

As a result of this effect the accelerator nerves have full play, and more impulses reach the heart to make it beat stronger and faster.

Action on the blood vessels: The blood vessels of the abdomen are narrowed by the contractions of their muscle fibers, as a result of impulses which reach them from the vaso constrictor center in the medulla of the brain. **The blood vessels of the skin, however, are widened.** This causes the flushing of the face and neck and other parts of the skin, often produced by atropine. **The blood pressure is increased,** however.

The **pulse resulting from atropine is therefore rapid, strong, and tense.**

(Occasionally atropine may make the pulse slow for a few moments.)

Action on the respiration: Atropine makes the breathing faster and deeper. More air, and therefore more oxygen, is taken into the lungs. The blood is then able to take up more oxygen and to get rid of its waste products more rapidly.

Action on the nervous system: Atropine increases the

activity of the brain. This produces wakefulness and restlessness, because the patient is more conscious. This results because the areas of the brain which receive sensations, are made more active. More sensations are then received through the various senses.

The patient is more active and more talkative, because the motor and speech areas of the brain are more active, and these areas send out more impulses.

In overdoses, atropine causes symptoms of lessened activity of the brain (depression), because the brain then becomes exhausted from over activity.

Action on the secretory glands: The secretion of all the secretory glands is diminished by atropine. This effect is produced by paralyzing the nerve endings in the glands of the nerves which cause secretion.

The secretion of saliva, of the mucous glands of the nose, throat, larynx, and bronchi are diminished.

This causes the dryness of the mouth and throat and the resulting excessive thirst. Hoarseness also occasionally occurs from checking the secretion of the secretory glands in the larynx.

The secretions of the glands in the mucous membranes of the stomach and intestines are checked. The secretion of pancreatic juice and of bile is also lessened.

Atropine also lessens the action of the cells of the liver, so that less sugar is formed from the glycogen, or animal sugar, which is stored up in the liver.

Atropine checks especially, the secretion of sweat and milk. The secretion of the kidney, however, is not affected by atropine.

Action on the involuntary muscles: Atropine lessens the contractions of all the involuntary muscles, by paralyzing the nerve endings of the nerves which carry impulses to these muscles. The contractions of all organs containing involuntary muscles are therefore lessened.

Thus, the peristalsis of the stomach and intestines is lessened. The contractions of the bladder and uterus are soothed by atropine, and the contractions of the bronchial muscles are also lessened.

(Atropine, or drugs containing atropine, are often used to relieve contractions of these muscles which often produce asthmatic attacks.)

Action on the pupil: Atropine dilates the pupil by paralyzing the nerve endings of the nerves in the circular muscle fibers of the iris, or colored part of the eye. The radial muscles then have free play, and their contractions widen the pupil. The widening of the pupil may last for days.

After atropine, patients are unable to see near objects clearly. This is due to the paralysis of the nerve endings of the ciliary muscle, a muscle which changes the contour of the lens for near and distant objects (accommodation). The relaxation of this muscle, prevents the lens from changing its contour for near objects, which cannot then be seen.

Effect on the temperature: Atropine often causes a rise of temperature.

Excretion

Atropine or a drug containing atropine, is excreted mainly by the kidneys. It is eliminated in about ten to twenty hours after being given.

Idiosyncrasies

The following unusual effects occasionally occur:

1. Ordinary doses of atropine sometimes cause delirium.
2. When applied to the conjunctiva of the eye, atropine often causes inflammation of the eyelids and face.
3. The rash caused by atropine, may spread all over the body, and the skin may peel (desquamate). This rash may be mistaken for scarlet fever.

Poisonous Effects

Acute atropine poisoning usually results from excessive doses of atropine or drugs containing atropine. Dangerous symptoms have occurred from gr. $\frac{1}{20} - \frac{1}{10}$ and death has occurred in about six hours after it was taken.

Since atropine is rapidly excreted, cumulative symptoms, or chronic atropine poisoning does not occur.

Symptoms

The earliest and most characteristic symptoms of atropine poisoning are:

1. **Dryness of the mouth and throat.**
2. Excessive thirst.
3. Difficulty in swallowing.

These symptoms result because the secretions of the mouth and throat are checked. In addition to these symptoms there may be:

4. Hoarseness.
5. Occasionally nausea and vomiting.
6. Often headache and dizziness.
7. **Redness and dryness of the skin,** especially of the face and neck.
8. **The pulse and breathing is very rapid** at this time.
9. **The pupils are widely dilated** and the sight for near objects is indistinct.

If very large doses of atropine are taken, these symptoms are soon followed by:

1. Intense thirst with inability to swallow.
2. Great hoarseness with difficult and indistinct speech.
3. The pulse becomes rapid, 150 to 160, and the breathing is very rapid.
4. The pupils are widely dilated, and the eyes are very staring.
5. **There is often restlessness and other symptoms resulting from excessive activity of the brain.**

The patient may have a staggering gait and be very active, is very talkative, but his ideas are easily confused. He may begin a sentence and not finish it. He is very light-headed, may burst out into laughter or tears. Occasionally there may be various illusions; especially illusions or hallucinations of sight. Patients often see various objects about them which are not present.

The patient then becomes **delirious. The delirium is peculiarly wakeful, active, and talkative.** The patient lives in a world of his own. He is constantly interested in talking to objects and persons which he seems to see about him and which occupy his entire attention. He is entirely

unconscious of the real objects present about him. Often the patient becomes quarrelsome, even maniacal, and has to be restrained.

Finally, tremors of the muscles develop, the patient may have **convulsions** followed by paralysis. The breathing becomes slow and shallow, the face blue, and the patient dies from cessation of breathing.

Usually however, the **excessive excitement is followed by a deep sleep which gradually becomes still deeper (stupor).** The patient then goes into **coma** (a very deep sleep from which he cannot be awakened). The breathing becomes slow and shallow, the face is blue (because of the insufficient oxygen entering the lungs), the pulse becomes slow, irregular and weak, the temperature is below normal, the extremities are cold and the patient dies from asphyxia.

All these symptoms are the result of excessive stimulation of the brain, of the heart and the respiration, as a result of atropine. This causes the violent talkative delirium. The illusions of sight are produced by the excessive activity of the area of the brain where impressions of sight are received and stored up. Old impressions that had been received and stored up in the brain are thus sent out, and the patient seems to see the objects which are not present.

The very rapid pulse, and respiration too, are evidences of over stimulation. When the heart and respiration become exhausted, however, from this over activity, the pulse and respiration both become slow.

The dryness of the throat and the dilatation of the pupil, which are so characteristic of atropine action, are due to the excessive effect of atropine on the nerve endings.

The stupor and coma are the symptoms of exhaustion which result from the excessive over activity of the brain.

Treatment of Atropine Poisoning

1. Wash out the stomach, or give emetics.
2. Give cathartics.
3. Catheterize the patient, to avoid reabsorption of the atropine from the urine in the bladder, especially since the patient does not pass much urine in atropine poisoning.

4. Give tannic acid, as this combines with the atropine and neutralizes it.

5. Keep the body warm, give mustard baths.

6. Give artificial respiration if the breathing is embarrassed.

7. Give heart and respiratory stimulants such as whiskey, caffeine, strychnine, etc.

8. **Do not give morphine,** for, while atropine, is the antidote for morphine, the dangerous effects of atropine are due to the exhaustion of the breathing. If morphine is given in such cases, the breathing is only made slower. Morphine, therefore is not an antidote for atropine, though atropine is an antidote for morphine.

Uses

The most important uses of atropine or belladonna are.

1. In the form of a belladonna plaster or liniment, atropine or belladonna is used to relieve pain, on the area where it is applied.

2. As a cardiac and respiratory stimulant, especially where immediate effects are desired.

3. As an antidote for morphine poisoning. It is very often given together with morphine to avoid poisonous effects.

4. Atropine is often given to check secretions, for example—to check profuse sweating, or to check the secretion of milk.

5. To lessen cramp-like pains produced by contractions of involuntary muscles. **It is often prescribed together with purgatives to lessen their griping. It relieves the colic** which is produced by the contractions of the involuntary muscles of the bile ducts resulting from the passage of a stone along these ducts. For the same reason, it relieves the colic of the ureters of the kidney (renal colic) resulting from the passage of a stone or other substance along the ureter.

By lessening the contractions of the involuntary muscles of the stomach, **it often relieves the pains of ulcers of the stomach.**

It frequently relieves painful urination which is produced

by the spasmodic contractions of the involuntary muscles at the neck of the bladder.

6. Atropine is very often used to relieve bronchial asthma. It is particularly valuable in this condition, because it lessens the spasm of the involuntary muscles of the bronchi, and at the same time it checks the secretion of its mucous membranes.

7. Atropine is very often used to dilate the pupil, so that the retina or background of the eye may be more easily examined, and to prevent adhesions between the iris and lens, when the iris is inflamed.

8. It is very often used in diabetes in large doses. It lessens the amount of sugar present in the urine. The reason for this effect is unknown, but it is probable that it may be due to atropine lessening the formation of sugar in the liver cells.

Preparations

Preparations Made from the Leaves

For Internal Use

Extract of Belladonna Leaves 0.005–0.03 gm. gr. $\frac{1}{12}$–$\frac{1}{2}$
(Extractum Belladonnae Foliorum)

Tincture of Belladonna Leaves 0.3 –1.0 c.c. m. v–xv
(Tinctura Belladonnae Foliorum)

For Local Use

Belladonna Ointment
(Unguentum Belladonnae)

This contains about 10% of the extract of belladonna.

Belladonna Plaster
(Emplastrum Belladonnae)

This contains 3 parts of the extract of belladonna and 7 parts of adhesive plaster.

Preparations Made from Belladonna Root

For Internal Use

Fluidextract of Belladonna Root 0.06–0.12 c.c. m. i–ii
(Fluidextractum Belladonnae Radicis)

For Local Use

Belladonna Liniment
(Linimentum Belladonnae)

This consists of the fluid extract to which has been added about 5% of camphor.

Preparations of Atropine

For Internal Use

Atropine (Atropina)	0.0004–0.001 gm.	gr. $\frac{1}{160}$ – $\frac{1}{60}$
Atropine Sulphate (Atropinae Sulphas)	0.0004–0.001 gm.	gr. $\frac{1}{160}$ – $\frac{1}{60}$

For hypodermic use, atropine often comes in tablets, each containing the required dose, or in ½ to 1% solutions.

For Local Use

Oleate of Atropine
(Oleatum Atropinae)

This contains about 2% of atropine.

Atropine Ointment
(Unguentum Atropinae)
(Not official)

This contains about 4% of atropine.

Homatropine

Homatropine is a compound of tropine, an alkaloid obtained by decomposing atropine, combined with oxytoluic acid.

Its effects are similar to those of atropine. It dilates the pupil more rapidly than atropine, and the effect is not so lasting. It is said to slow the pulse, instead of making it more rapid. It is not so apt to cause general symptoms as easily as atropine from its local use; as in its applications to the eye.

Homatropine is used principally to dilate the pupil. It is dropped locally into the conjuctiva.

Preparations

Homatropine Hydrobromide. 0.0006–0.001 gm. gr. $\frac{1}{100}$–$\frac{1}{60}$ **(Homatropinae Hydrobromidum)**

It is used principally in ½ to 1% solutions for local applications in the eye.

STRAMONIUM (THORN APPLE, JAMESTOWN WEED)

Stramonium is obtained from the leaves of the **Datura stramonium,** a weed growing in England and the United States. It is known by various names, such as Jamestown weed, thorn apple, or gypsum. Its active principles are the alkaloids, **atropine** and **hyoscyamine,** and it also contains small quantities of **hyoscine.**

Appearance of the Patient

When a preparation of stramonium is given, or the fumes of burnt stramonium leaves inhaled, the patient is relieved of the asthmatic attack from which he may be suffering. The breathing is easier, the pulse is strong and rapid. The patient complains of dryness of the mouth and throat and is very thirsty. The pupils are dilated, and the patient is somewhat more active and more talkative.

ACTION

The effects of stramonium are like those of belladonna; and are due principally to the atropine which it contains.

Local action: Applied to the skin, stramonium relieves pain and checks the secretion of sweat. **On mucous membranes:** It checks the secretions.

Internal Action

In the mouth: Stramonium checks the secretions.

In the stomach and intestines: The secretions and peristalsis are increased.

Action after Absorption

Stramonium is rapidly absorbed through the mucous membrane of the stomach. It is usually given by inhalation, by burning the stramonium leaves. It is then rapidly

absorbed through the mucous membrane of the lungs. After absorption, stramonium affects the same organs as atropine and it produces the same effects.

Action on the heart: It makes the heart beat stronger and faster and makes the **pulse stronger and faster.**

Action on the respiration: Stramonium makes the breathing deeper, and faster, but easier.

Action on the brain: It makes the patient more wakeful, more active, and more talkative, because of the increased activity of the brain.

Action on the secretory glands: Stramonium lessens the secretion of all the secretory glands. The secretion of saliva, mucus in the nose, throat and bronchi is lessened. Sweat, milk, pancreatic juice, bile, and the secretion of the stomach and intestines are all lessened.

Action on the involuntary muscles: Stramonium lessens the contractions of all the involuntary muscles, such as the muscles of the stomach, intestines and bladder.

It lessens particularly the contractions of the involuntary muscles of the bronchi. It is frequently used for this purpose, to relieve an attack of asthma by relaxing the involuntary muscles of the bronchi, the contractions of which cause the attack.

Action on the pupil: Stramonium dilates the pupil, like atropine.

Excretion

Stramonium is excreted mainly by the kidney.

Poisonous Effects

Overdoses of stramonium produce the same effects as atropine poisoning. The characteristic symptoms are the dilated pupils, the dryness of the mouth and throat, the flushed skin, the rapid pulse which has a tendency to become intermittent, the rapid breathing, restlessness, talkative delirium, stupor, coma and death. The treatment is the same as for atropine poisoning.

Uses

Stramonium is often used to relieve spasmodic asthma.

It is given in the form of cigarettes, which are smoked during the attack, or the leaves are burnt and the smoke inhaled. It relieves the attack by relaxing the spasm of the involuntary muscles of the bronchi.

Preparations

Stramonium leaves made up in the form of cigarettes, or the plain dried leaves.

Extract of Stramonium (Extractum Stramonii)	0.015–0.03 gm.	gr. $\frac{1}{4}$–$\frac{1}{2}$
Fluidextract of Stramonium (Fluidextractum Stramonii)	0.06 –0.12 c.c.	m. i–ii
Tincture of Stramonium (Tinctura Stramonii)	0.3 –1.0 c.c.	m. v–xv
Stramonium Ointment (Unguentum Stramonii)		

This contains 10% of the extract of stramonium. It is used principally for painful haemorrhoids.

HYOSCYAMUS

Hyoscyamus is obtained from the leaves and flowering tops of **Hyoscyamus niger** or **henbane,** when the plant is two years old. It grows best in England, but it has been successfully cultivated in the United States. Its active principles are the alkaloids **hyoscyamine, hyoscine** and small quantities of **atropine.**

Hyoscyamine and hyoscine are chemically very much like atropine.

The effects of hyoscyamus are quite similar to those of belladonna and atropine, except that it does not cause such increased activity of the brain. This is due to the hyoscine which it contains. This produces sleep and therefore lessens the excitement.

Appearance of the Patient

After administering hyoscyamus, the appearance of the patient is the same as after atropine.

ACTION

Local action: Applied to the skin, it relieves pain on the region where it is applied and checks the secretion of sweat. **On mucous membranes:** It checks the secretions.

Internal Action

In the mouth: It has a bitter taste and it checks the secretion of saliva.

In the stomach and intestines: The secretion of gastric and intestinal juices is lessened. The digestion of food is therefore retarded. The peristaltic contractions of the stomach and intestines are also lessened by hyoscyamus.

Action after Absorption

Hyoscyamus is rapidly absorbed from the stomach. After absorption it affects principally the heart, the respiration, the brain, all the secretory glands, the involuntary muscles and the pupil.

Action on the heart: Hyoscyamus makes the heart beat stronger and faster. More blood is therefore expelled by the contractions of the heart, and with greater force. The **pulse** is therefore **rapid and strong.** It is not as rapid, however as after atropine.

Action on the respiration: Hyoscyamus makes the breathing faster and deeper.

Action on the brain: The effects of hyoscyamus on the brain differ somewhat from those of atropine. On account of the greater amount of hyoscine contained in hyoscyamus, the patient is less active and talkative, and does not move about as much as after atropine. There is a tendency to lessen the activity of the brain, so that very often sleep is produced because of the contained hyoscine, which lessens the activity of the brain.

Action on the secretory glands: The secretion of all the secretory glands is lessened by hyoscyamus, in the same way as with atropine. There is therefore less saliva, less pancreatic juice, less gastric juice, and less bile secreted. The secretion of mucus in the nose, mouth and throat and the secretion of sweat and milk are all diminished.

Action on the involuntary muscles: Hyoscyamus lessens the contractions of involuntary muscles. This effect is almost twice as strong as from atropine. It is used particularly for this purpose to relax the spasm of the sphincter muscle at the neck of the bladder, which often causes painful urination.

Action on the pupil: Hyoscyamus dilates the pupil more slowly than atropine, and makes the patient unable to see near objects distinctly, in the same way as atropine does.

Excretion

Hyoscyamus is rapidly excreted, mainly by the kidneys.

Poisonous Effects

The poisonous effects of hyoscyamus are the same as those of atropine. (See atropine poisoning.) The dry mouth, thirst, dilated pupils, rapid pulse, and breathing, and the delirium are the characteristic symptoms. The treatment is the same as for atropine poisoning.

Preparations

Extract of Hyoscyamus (Extractum Hyoscyami)	0.03–0.2 gm.	grs. ½–iii
Fluidextract of Hyoscyamus (Fluidextractum Hyoscyami)	0.3 –1.0 c.c.	m. v–xv
Tincture of Hyoscyamus (Tinctura Hyoscyami)	1.0 –4.0 c.c.	m. xv–℥i

HYOSCYAMINE

Hyoscyamine is very rarely used. Its effects are the same as those of atropine, to which it is very closely related. It lessens the contractions of all the involuntary muscles more than atropine.

Preparations

Hyoscyamine Sulphate (Hyoscyaminae Sulphas)	0.0005–0.001 gm.	gr. $_{1}\frac{1}{2}\frac{1}{0}$ – $\frac{1}{6}\frac{1}{0}$
Hyoscyamine Hydrobromide (Hyoscyaminae Hydrobromidum)	0.0005–0.001 gm.	gr. $_{1}\frac{1}{2}\frac{1}{0}$ – $\frac{1}{6}\frac{1}{0}$

HYOSCINE OR SCOPOLAMINE

Appearance of the Patient

About a half to one hour after the administration of hyoscine, the patient feels tired and drowsy. He becomes less active, less talkative and soon falls asleep. The sleep resembles the normal sleep, and lasts from about five to eight hours, though the patient may feel drowsy for some time after that. The pulse and breathing are slow, and the pupils are dilated. When the patient awakes, he usually complains of dryness of the throat and mouth, and is very thirsty.

Hyoscine produces sleep more easily, if the room is darkened and loud noises avoided.

ACTION

The action of hyoscine resembles that of atropine with the following differences:

1. **Action on the pupil:** It dilates the pupil more rapidly than atropine, but the effects last for only a short time.
2. **Action on the heart:** It makes the heart beat slower. **The pulse is therefore slower after hyoscine.**
3. **Action on the respiration:** Hyoscine makes the breathing slower.
4. **Action on the brain:** The activity of the brain is lessened by hyoscine. **It produces sleep,** by lessening the action of the sensory areas of the brain. Fewer sensory impressions are then received, consciousness is therefore lessened and sleep produced.

The action of the motor and speech areas of the brain is also lessened. The patient then feels tired, because he is less active and less talkative.

Occasionally, there is a short period of excitement before the patient falls asleep. The patient may then feel dizzy and be quite active, though his movements are uncertain; and his speech becomes difficult and uncertain.

Excretion

Hyoscine is excreted mainly by the kidneys, more rapidly than atropine; usually in about eight to ten hours.

Tolerance

Patients may get used to hyoscine, so that large doses may be given without producing any effects.

Poisonous Effects

The poisonous effects of hyoscine are similar to those of atropine. The patient has the characteristic symptoms of **wild talkative delirium, dryness of the throat and mouth, dilated pupils, dry red skin, rapid pulse and breathing, etc.**

Uses

Hyoscine is usually given hypodermically, to produce sleep; especially in cases of delirium, mania, delirium tremens, etc.

Hyoscine or scopolamine is often given together with morphine to produce a state of mild unconsciousness and anaesthesia, so that the surgeon is often enabled to perform an operation, such as the amputation of a limb, while the patient is under the influence of these drugs. It is also occasionally given before an anaesthetic is administered to lessen the time of anaesthesia.

Preparations

Hyoscine Hydrobromide 0.0003–0.0006 gm. gr. $\frac{1}{200}$ – $\frac{1}{100}$
(Hyoscinae Hyodrobromidum)

Scopolamine Hydrobromide
(Scopolaminae Hydrobromidum)

This is the same as hyoscine hydrobromide.

Euscopole (not official) 0.0003 gm. gr. $\frac{1}{200}$

This has a milder action than scopolamine.

SCOPOLA

Scopola is obtained from the underground stems of the **Scopola atropoides,** a plant which grows on the hills of

central and southern Europe. Its active principles are the alkaloids **atropine, hyoscyamine,** and **hyoscine** or **scopolamine.**

ACTION

The action of scopola resembles that of hyoscyamus.

It checks all secretions and lessens the contractions of all involuntary muscles.

It makes the heart beat faster and stronger, and the breathing faster and deeper.

It dilates the pupil. It has a soothing effect on the brain, producing sleep. It causes excitement and delirium only in poisonous doses.

Uses

It is occasionally used as a substitute for belladonna.

Preparations

Extract of Scopola (Extractum Scopolae)	0.015–0.03 gm.	gr. $\frac{1}{4}-\frac{1}{2}$
Fluidextract of Scopola (Fluidextractum Scopolae)	0.06 –0.12 c.c.	m. i–ii

Scopolamine hydrobromide is the same as hyoscine hydrobromide and is given in doses of 0.0003–0.0006 gm. gr. $\frac{1}{200}-\frac{1}{100}$

DUBOISIA

Duboisia is obtained from the **Duboisia myoporoides,** an Australian shrub. Its active principle is **duboisine,** an alkaloid which at one time consists of hyoscyamine and at other times of hyoscine. It is used to soothe excitement of the brain. Its action is like that of hyoscyamus. It is not often used.

MANDRAGORA (MANDRAKE)

Mandragora is obtained from the **Atropa mandragora,** or **Mandrogora autumnalis** or mandrake. Its active principles are **hyoscine,** and other alkaloids. It resembles hyoscyamus in its action. It is rarely used.

TABLE OF COMPARATIVE ACTION OF THE ATROPINE GROUP OF DRUGS

Name of Drug	Local Action	Absorption	Action on the Heart	Action on the Respiration	Action on the Brain	Action on Secretory Glands	Action on Involuntary Muscles	Action on the Pupil
Belladonna.	Relieves pain.	Rapid.	Pulse rapid.	Breathing rapid and deep.	Excitement and delirium.	Secretion lessened.	Contractions lessened.	Pupils dilated.
Stramonium.	Same.	Same.	Same.	Same.	Same.	Same.	Contractions lessened, particularly bronchial muscles.	Same.
Hyoscyamus.	Same.	Same.	Pulse not as rapid.	Same.	Soothes and produces sleep.	Same.	Contractions lessened, especially bladder muscles.	Same.
Scopola.	Same.	Same.	Pulse slower.	Same.	Soothes and produces sleep.	Same.	Contractions lessened.	Same.
Alkaloids. **Atropine.**	Same.	Same.	Pulse rapid.	Same.	Excitement and delirium.	Same.	Same.	Same.
Hyoscine.	Same.	Same.	Pulse slower.	Breathing slower.	Soothes and produces sleep.	Same.	Same.	Same.
Homatropine.	Same.	More rapid.	Pulse rapid.	Breathing rapid.	Excitement and delirium not very marked.	Same.	Same.	Pupils dilated more rapidly and for a short time.

COCA AND COCAINE

Coca is obtained from the dried leaves of the **Erythroxylon coca,** a shrub growing in Peru, Bolivia and other South American countries. It is now also cultivated in India, Java and Ceylon.

The coca leaves are extensively used by the natives of South America. They chew it particularly when they have hard work to do, as they then do not tire easily, and it lessens their hunger.

The active principle of coca is an alkaloid **cocaine.** In the Java coca, in addition to the cocaine, another alkaloid is present, **tropacocaine.** Cocaine is easily decomposed and various artificial combinations of it are made; such as cocamine, isococamine, etc.

The effects of the coca leaves are due principally to the cocaine which it contains. In practical medicine, the preparations of the alkaloid cocaine are principally used.

Appearance of the Patient

A hypodermic injection of an average dose of cocaine, or if it is applied to the mucous membranes, usually produces insensibility to pain on the area where it is injected or applied. As soon as the cocaine is absorbed, usually in ten or fifteen minutes, the patient becomes restless, somewhat more active, and more talkative. He usually feels happy and joyful. The patient often complains of headache, dryness of the throat, the pulse is rapid, strong and small, the breathing is rapid and deep, and the pupils are dilated.

ACTION

Local action: Applied to the skin, cocaine produces no effects, but if it is injected under the skin, or applied to a wounded surface, it relieves pain. If it is injected into a nerve, it lessens pain in the area of skin from which the nerve fibers come.

On mucous membranes: Cocaine relieves pain and makes the membrane very pale and thin, by contracting its blood

vessels. It also checks bleeding by contracting the blood vessels.

The insensibility to pain, or anaesthesia, produced by cocaine, lasts only for a short time; for about fifteen minutes to a half hour, depending on the strength of the solution used. As soon as the cocaine is absorbed, the anaesthesia and pallor disappear. **Cocaine produces insensibility to pain by paralyzing the nerve endings, in the skin or mucous membranes, which receive impressions of pain.**

The mucous membrane of the eye, nose, pharynx, larynx, oesophagus, stomach, urethra, bladder, vagina and rectum, are all affected in this way, if cocaine is applied directly to these mucous membranes, and it is absorbed from all of them. **In the nose,** in addition to the effects on the mucous membrane, it lessens the sense of smell, by paralyzing the nerve endings which receive impressions of smell.

Internal Action

In the mouth: Cocaine has a bitter taste for a short time, as it soon paralyzes the nerve endings in the tongue which appreciate bitter substances. It also lessens pain on the mucous membrane of the mouth, and contracts its blood vessels.

In the stomach: Cocaine acts as a local anaesthetic, and it contracts the blood vessels of the mucous membrane. It often lessens vomiting and hiccough, by paralyzing the nerve endings in the stomach, so that no impulses can reach the brain, to cause vomiting or hiccough.

Action on the intestines: Since cocaine is so rapidly absorbed from the stomach, it affects the intestines only after absorption. It increases the peristalsis, causing more frequent movements of the bowels.

Action after Absorption

Cocaine is very rapidly absorbed into the blood from all mucous membranes, and from any region of the body where

it may be injected; usually in about ten or fifteen minutes. After absorption it affects principally the circulation, the respiration, the brain, the pupil, the kidney, and slightly the muscles.

Action on the circulation: On the heart: Cocaine makes the heart beat stronger and faster. It increases the contractions of the heart muscle, and it also causes the cardio accelerator center in the medulla of the brain, to send more impulses to the heart to make it beat faster.

On the blood vessels: Cocaine makes the blood vessels narrower, by contracting the fine muscle fibers in their walls, and increasing the impulses for their contraction, which are sent out from the vaso-motor center in the medulla of the brain.

The total effect of cocaine on the circulation, is to make the heart beat stronger and faster, and to increase the blood pressure. **The pulse is therefore rapid, strong, but small.**

Action on the respiration: Cocaine makes the breathing faster and deeper.

Action on the brain: It increases the activity of every part of the brain. The patient is wakeful, and more susceptible to receive impressions from his surroundings, as a result of the increased activity of the sensory areas of the brain. He is usually more active, and is able to do more work and with less fatigue. He can stand hunger for a longer time. The patient is more talkative. These effects are due to the increased activity of the motor and speech areas of the brain.

The mental activities of the brain are also increased, so that all kinds of mental work such as reasoning, memory, etc., are performed better.

The emotions are more active, especially the pleasant ones, and the patient is somewhat joyful and happy.

Overdoses cause, at first, greatly increased activity of the brain, and then, from exhaustion, very much lessened activity (see poisonous effects).

Action on the muscles: Cocaine slightly increases the contractions of all the muscles.

Action on the pupil: It rapidly dilates the pupil, usually in about a half to one hour. It does not affect the sight for

near and distant objects (accommodation). The effect wears off in about twenty-four hours.

Action on the kidney: Cocaine increases the secretion of urine, as a result of its effect on the circulation, and the blood vessels of the kidneys.

Excretion

Cocaine is partly excreted by the urine, and partly destroyed in the body.

Poisonous Effects

Cocaine poisoning occurs in two forms, **acute cocaine** poisoning, and **cocaine habit,** or **chronic cocaine poisoning.**

Acute Cocaine Poisoning

Acute cocaine poisoning results from overdoses of cocaine injected hypodermically, or applied to mucous membranes for local anaesthesia. The symptoms are due to overactivity of the various organs of the body which cocaine affects, followed by exhaustion of these organs, which then produce symptoms of lessened activity or depression. The symptoms vary somewhat in different individuals. Some individuals are so susceptible to the drug that small doses may cause poisonous effects.

Symptoms

1. Usually the patient becomes **quite talkative, happy and jolly,** though he may be somewhat confused in his speech and ideas.
2. He is quite **active and moves about a great deal.**
3. **The pulse is very rapid and small, and the breathing is very rapid.**
4. The skin is pale, and covered with sweat.
5. The pupils are widely dilated.
6. Occasionally there may be vomiting.

Soon the **delirium** becomes more marked, the patient may see objects about him, he may have muscular contractions of

the hands and feet, which are soon followed by either **clonic** or **tonic convulsions,** more often clonic. The pulse becomes very rapid, intermittent and weak, and the breathing soon becomes shallow. The skin is blue and cold, though the temperature may be increased, and the pupils are widely dilated.

Soon the convulsions increase. The pulse becomes slow and weak, the breathing very shallow and irregular, and the patient dies from paralysis of respiration, but is conscious to the very last. At times there may be no convulsions and no excitement, but the patient soon dies of collapse. At other times the patient may be maniacal.

Treatment

1. If the cocaine has been taken by mouth, the stomach should be washed out.
2. The best drug which antagonizes the action of cocaine, is amyl nitrite given by inhalation, or nitroglycerin, given hypodermically. This lessens the overacting heart and respiration.
3. For the convulsions and delirium, inhalations of chloroform should be given.
4. To prevent the convulsions from returning, chloral, opium, or morphine should be given.
5. The collapse should be treated by artificial respiration and cardiac stimulants, such as ammonia, whiskey, caffeine, etc.

COCAINE HABIT OR CHRONIC COCAINE POISONING

The cocaine habit is unfortunately very common, and is often induced by its beneficial effects in the nose for the relief of hay fever, catarrh, etc., often from its use as a substitute for morphine. It is usually taken in the form of a powder or liquid, which is snuffed up in the nose. Many of the cocaine habitués are also addicted to the use of other habit-forming drugs, such as morphine, etc. The symptoms of the cocaine habit are most pernicious, and are responsible for many ruined lives.

Symptoms

The earliest symptoms resulting from the continued use of cocaine are **various digestive disorders; loss of appetite, foul breath,** excessive flow of saliva and **loss of weight.** The patient is **dull and listless,** his **gait is uncertain** and his **eyes are sunken.** Soon the patient suffers from **sleeplessness,** frequently he has **tremors of the muscles** of the face and hands, and occasionally convulsions. He is **careless about his person** and his actions, and he has no will power. Very often he has **delirium and hallucinations** and even various forms of **insanity** may develop. Sometimes ascites (fluid in the abdomen) develops and death may result from great wasting.

When the cocaine is stopped, these symptoms gradually disappear.

Uses

Cocaine is used principally as a local anaesthetic. Many surgical operations can thus be performed after it is injected into the region to be operated upon, or when it is applied to the mucous membranes. It is extensively used in nose and throat operations. The poisonous symptoms of cocaine, which result from its absorption, can often be avoided by using a solution of cocaine, together with adrenalin; the adrenalin contracts the blood vessels and thereby lessens the absorption.

It is also used to relieve colds in the nose (acute coryza), and to check vomiting and hiccough.

Preparations

Coca

Fluidextract of Coca (Fluidextractum Cocae)	2.0–4.0 c.c.	ʒ½–i
Wine of Coca (Vinum Cocae)	4.0–16.0 c.c.	ʒi–ʒ½

Cocaine

Cocaine (Cocaina)	0.008–0.03 gm.	gr. ⅛–½

This is seldom used because it does not dissolve very easily in water.

Cocaine Hydrochloride 0.008–0.03 gm. gr. $\frac{1}{8}-\frac{1}{2}$
(Cocainae Hydrochloridum)

For local applications, watery solutions are used in strengths varying from $\frac{1}{2}\%$ to 10%. For nose and throat work 20% solutions are often used, or even the powdered cocaine dissolved in adrenalin solution may be used.

The amount of cocaine used to produce local anaesthesia varies with the strength of the solution. The total amount injected should never contain more than the average dose of cocaine, $\frac{1}{8}$ to $\frac{1}{2}$ grain, no matter what strength of solution may be used. Poisonous symptoms are thus avoided.

There are a number of artificial alkaloids, which resemble cocaine in its action, and are used as local anaesthetics. The most important of these are **eucaine, tropococaine, holocaine, stovaine, alypin, etc.** Their action will be considered later, under local anaesthetics.

Eupthalmin (Not official)

This is an artificial alkaloid which is used in 2% solutions to dilate the pupils. It does not affect the circulation.

NUX VOMICA AND STRYCHNINE

Nux vomica is obtained from the seeds of the **Strychnos nux vomica,** and **Strychnos ignatia,** a middle sized tree, growing in the East Indies. These seeds are round, flat discs about the size of a five cent piece, and are often called **poisoned nut** or **quaker buttons,** because they resemble gray buttons.

The active principles are two alkaloids, **strychnine** and **brucine.** The effects of both of these are the same; brucine being half as strong as strychnine. It also contains an acid, **igasuric acic.**

The action of nux vomica is due to the strychnine which it contains, so that the effects of the drug are the same as those of its active principle.

Appearance of the Patient

When strychnine or a preparation of nux vomica is given, the patient complains of its very bitter taste. The appetite is increased and digestion is better. The patient feels stronger and more hopeful. The pulse is slower and stronger, and the breathing is deeper and faster.

All the sensations are better appreciated. The sight is better and the hearing is more acute. The sense of touch is more delicate. The body responds quicker and more vigorously to all impressions received through the various senses. These effects are often only noticed when the drug is given continuously for some time.

ACTION

Local action: No effects are produced when either nux vomica or strychnine are applied to the skin or mucous membranes.

Internal Action

In the mouth: Strychnine has a very bitter taste. It is one of the bitterest substances known; a 1–20,000 solution gives an extremely bitter taste. Because of this bitter taste, it increases the appetite and the flow of saliva.

In the stomach: Strychnine increases the secretion of gastric juice, and the peristalsis of the muscle wall of the stomach. The digestion is thus aided, and the food is quickly passed on to the intestines.

In the intestines: It increases the secretion of the mucous membranes and the peristalsis. Frequent movements of the bowels then result.

The increased peristalsis of the stomach and intestines produced by strychnine, is due to its effect on the mucous membrane of these organs, and to its action on the spinal cord. The effect on the mucous membranes, sends impulses to the spinal cord, which is made more active by strychnine. The spinal cord then sends out more and faster impulses to contract the muscles of the stomach and intestines.

Action after Absorption

Strychnine is absorbed into the blood mainly from the intestines, in about one or two hours. After absorption, it affects principally the circulation, the respiration, and the spinal cord.

Action on the circulation: On the heart: Strychnine makes the heart beat slower, by sending more impulses from the vagus or inhibitory center in the medulla, to make the heart beat slower.

On the blood vessels: It makes the blood vessels narrower; especially the blood vessels in the abdomen. This is due to the effect on the vaso-motor center in the medulla, an area of gray matter which sends out impulses to control the width of the blood vessels. Strychnine makes this center more active. More impulses are then sent to the muscle fibers in the walls of the blood vessels to make them contract. The blood vessels then become narrower, and offer a greater resistance to the contractions of the heart, which then beats stronger. The blood pressure is also increased by the contraction of the blood vessels.

The total effect of strychnine on the circulation is therefore to **make the heart beat slower and stronger.** The characteristic **strychnine pulse is slow and strong.**

Action on the respiration: The breathing is deeper and faster because of the increased impulses for breathing sent out by the respiratory center in the medulla.

Action on the nervous system: Strychnine does not affect the brain.

Action on the sensations: Strychnine increases the appreciation of all the various sensations. The patient is able to see and to hear somewhat better, and to appreciate various objects better through the sense of touch.

Action on the spinal cord: This is the most important action of strychnine. Most of the strychnine effects result from its action on the spinal cord and the medulla.

It increases the activity of all the cells of the gray matter of the spinal cord and the medulla oblongata. As a result of this action, all the activities of the body which are due to

impulses received through the various senses, are increased (reflex action).

In this way, strychnine acts as a tonic, improving the activity of every part of the body. The patient responds better and quicker to all the impressions received through the various senses. He is therefore somewhat brighter, and his muscles contract better, because they respond more easily, to impressions received through the various senses, so that the individual is able to do more work, after continued strychnine administration.

The appetite and digestion are better, and the bowels move more often, because of the increased reflex action which makes the gastric and intestinal muscles respond more easily to any substance affecting their mucous membrane.

The heart beats stronger, and the breathing is faster and deeper.

As a result of all these effects on the various organs of the body, the patient feels stronger, healthier and more robust.

Excretion

Strychnine is excreted mainly by the kidneys, though very slowly. It takes about three to seven days for the drug to be entirely excreted.

Poisonous Effects

Strychnine poisoning occurs in two forms; acute strychnine poisoning and chronic strychnine poisoning, or cumulative effects.

Acute Strychnine Poisoning

Acute strychnine poisoning usually results from giving an overdose of strychnine, or when it is taken with suicidal intent. The symptoms appear very soon after it is taken, usually in about fifteen minutes.

Symptoms

1. The patient first complains of **stiffness of the muscles** of the neck or face, and of slight stiffness of the jaw.
2. Soon a slight touch or gust of air in the room or even

a slight sound will cause a **violent twitching of the face or arms.**

3. This is accompanied by restlessness and slight movement of the face and muscles of the arms.

4. **Sudden tetanic convulsions of the whole body then occur.** The arms and legs are rigid and extended. The head is drawn back, and the back is bent so that it forms a concavity (opisthotonus). The contractions of the facial muscles draw up the corners of the mouth, causing a peculiar grin and ghastly expression known as the "risus sardonicus."

The convulsions are due to the increased reflex action; and are brought on by the slightest stimulus, such as a gust of air, the touch of a blanket, etc. After the convulsion, all the muscles are relaxed, but the slightest touch or a gust of wind, or a loud noise, at once produces another paroxysm.

5. The contractions of the muscles of the diaphragm, during the convulsions, give the **face and lips a blue color,** from the lack of oxygen in the blood, due to the interference with the breathing.

6. **The pulse is slow and stronger,** but during the convulsions it is often rapid.

7. The convulsions then become more frequent, and the patient finally dies of asphyxia, in about two or three hours; the mind remaining clear to the end.

These symptoms of strychnine poisoning are all due to its effect on the spinal cord. The activity of the gray matter of the cord is increased so much, that even the slightest stimulus causes such a marked response, so many impulses being sent out from the cord, that violent contractions of all the muscles of the body, or convulsions result. In a normal individual, however, an external stimulus such as touching the skin, etc., sends an impulse to the spinal cord which results in the contraction of only one, or of a number of muscles; so as to take the arm or leg away from the stimulus.

Treatment

1. Give tannic acid to combine with the strychnine.

2. Wash out the stomach or give emetics if strychnine has been taken by the mouth.

3. If the patient has convulsions, give chloroform or ether to control them, and then wash out the stomach.

4. To prevent the convulsions from returning, give chloral or bromides repeatedly.

5. Catheterize the bladder to prevent reabsorption of the strychnine in the urine.

6. Give artificial respiration and oxygen when the patient is blue and cyanotic.

Cumulative Action or Chronic Strychnine Poisoning

Since strychnine is rapidly absorbed and very slowly excreted, some of it always remains in the body if it is given continuously, and often causes cumulative symptoms. These symptoms, which result from the accumulation of strychnine in the body, are the same as the acute symptoms, but they develop more slowly.

Symptoms

1. The earliest symptoms which indicate that the patient is getting too much strychnine, are **twitching of the muscles of the face** or of the **extremities,** which may follow the slightest touch.

2. Often the earliest symptom may be **diarrhoea.**

3. Soon the patient complains of stiffness of the neck and jaw.

If the drug is continued, convulsions may occur.

Treatment

1. Stop the drug as soon as the earliest symptoms are noticed. This allows the strychnine in the body to be excreted, and further symptoms are avoided. If other symptoms occur, the treatment is the same as for acute poisoning.

Uses

Strychnine is used principally:

1. As a heart and respiratory stimulant in collapse.

2. In various forms of paralysis, to increase the contractions of the muscles.

3. As a tonic, to improve the general health and strength of the body.

4. To increase the appetite and to improve the action of the bowels.

Administration

For rapid effect in collapse, strychnine should be given hypodermically.

To increase the appetite, nux vomica is usually given before meals.

Preparations

Nux Vomica

Solid Preparations:

Extract of Nux Vomica (Extractum Nucis Vomicae)	0.015–0.06 gm.	gr. $\frac{1}{4}$–i

Fluid Preparations:

Fluidextract of Nux Vomica (Fluidextractum Nucis Vomicae)	0.06 –0.3 c.c.	m. i–v
Tincture of Nux Vomica (Tinctura Nucis Vomicae)	0.3 –1.0 c.c.	m. v–xv

This is the preparation most frequently used as a tonic.

Strychnine

Strychnine (Strychnina)	0.002–0.004 gm.	gr. $\frac{1}{30}$ – $\frac{1}{15}$
Strychnine Sulphate (Strychninae Sulphas)	0.002–0.004 gm.	gr. $\frac{1}{30}$–$\frac{1}{15}$

This is the preparation used hypodermically in collapse. In fluid form, it is most often used in a 1% solution.

Strychnine Nitrate (Strychninae Nitras)	0.002–0.004 gm.	gr. $\frac{1}{30}$ – $\frac{1}{15}$
Iron and Strychnine Citrate (Ferri et Strychninae Citras)	0.06 –0.2 gm.	gr. i–iii
Syrup of Iron, Quinine and Strychnine Phosphate (Syrupus Ferri, Quininae et Strychninae Phosphatum)	4.0 –8.0 c.c.	ʒi–ii

This contains $\frac{1}{80}$ of a grain of strychnine in each dose of ʒi.

Elixir of Iron, Quinine and Strychnine Phosphate

4.0–8.0 c c. ʒi–ii

(Elixir Ferri, Quininae et Strychninae Phosphatum)

It contains $\frac{1}{64}$ of a grain of strychnine in each ʒi dose.

PICROTOXIN (not official)

Picrotoxin is a neutral substance obtained from the fruit or fish berries, of **Anamirta paniculata,** a plant growing in Asia.

There are a number of similar substances found in various plants which produce the same effects as picrotoxin. The most common of these are:

Cicutoxin, the active principle of **Cicuta virosa** or water hemlock.

Oenanthotoxin, the active principle of **Oenanthe crocata** or water dropwort or dead tongue.

Phytolaccotoxin, the active principle of **Phytolacca** or poke root, a Japanese plant.

When a number of the active glucosides of digitalis are decomposed, they form substances which act like picrotoxin. For example:

Digitoxin forms toxiresin.

Digitalin forms digitaliresin.

ACTION

Picrotoxin acts very much like strychnine. Its principal effects are:

1. Nausea and vomiting.
2. Slow, strong pulse.
3. Rapid deep breathing.

In overdoses it causes:

1. Stupor, and unconsciousness, followed by:
2. Muscular twitchings.
3. Delirium.
4. Clonic convulsions.

Uses

It has been used locally in the form of an ointment to destroy pediculi, and for other skin diseases.

Preparations

Picrotoxin	0.001–0.003 gm.	gr. $\frac{1}{60}-\frac{1}{20}$

PHYTOLACCA

Phytolacca is obtained from the berries and roots, of **Phytolacca decandra,** a Japanese plant. Its active principle is **phytolaccotoxin,** which produces the same effects as picrotoxin.

Uses

It is used locally in various skin diseases. It is also said to reduce fat and is an ingredient of many anti fat remedies.

Preparations

Fluidextract of Phytolacca (Fluidextractum Phytolaccae)	0.3–2.0 c.c.	m. v–xxx

CEREBRAL TONICS

The following drugs increase the activity of the nervous system, by improving the nutrition of the brain and spinal cord.

PHOSPHORUS

Phosphorus is a non-metallic element obtained from bones by the action of sulphuric acid and water. It is a semi-solid, soft, wax like, colorless or yellowish substance, which emits light in the dark, and has an odor of garlic.

Phosphorus is found in the body in many tissues, especially in nervous tissue and bone. In the nervous tissues, phosphorus is present in large quantities combined with fats. They are called lecithins, or phosphorized fats. In the bones, phosphorus is present combined with calcium, sodium, or magnesium. It is also contained in many foods such as vegetables.

Appearance of the Patient

When oily preparations of phosphorus are given for some time, to patients suffering from neurasthenia, or other nervous diseases, the patient usually becomes more quiet, he is not as nervous and his mental activity is better. The appetite is better, the pulse is stronger, he breathes better and somewhat faster, and feels healthier, stronger and more robust.

ACTION

The action of phosphorus is quite similar to that of arsenic.

Local action: Applied to the skin, phosphorus causes inflammation, often the skin is destroyed, leaving an ulcer. **On mucous membranes:** It causes redness, swelling and inflammation.

Internal Action

In the mouth: Except for the slight redness of the mucous membrane, no effects are produced.

In the stomach: It increases the appetite, and the secretion of gastric juice, thus aiding digestion.

In the intestines: It causes increased secretion of the mucous membrane, thereby often producing frequent movements of the bowels.

Action after Absorption

Phosphorus is very slowly absorbed into the blood from the stomach. It is absorbed only from oily solutions, or when combined with glycerin in the form of glycerophosphates. It is also absorbed by the mucous membrane of the lungs when its fumes are inhaled. After absorption, it affects principally the nervous tissues, the bones and slightly the blood, heart and kidneys.

Action on the nervous tissues: Phosphorus slightly increases the activity of all the cells of the brain and spinal cord by improving their nutrition. It combines with the fats absorbed from the food, and forms lecithin, a substance which is contained in nervous tissues. In this way, phosphorus preparations, when given for a long time, will relieve many of the symptoms of neurasthenia, and "nervousness." These symptoms result from overwork or fatigue of the brain cells.

Phosphorus preparations, by improving the nutrition of the brain cells, relieve the condition of nervousness and irritability, and make the patient calmer and more quiet. They slightly improve all his mental activities, and the patient is not as nervous in his actions and speech.

Action on bone tissue: Phosphorus improves the nutrition of bone. It makes the spongy part of the bone firmer and harder, by improving the growth of the bone cells.

Action on the blood: Small continued doses of phosphorus, increase the number of the red blood cells.

Action on the heart: It makes the heart beat somewhat stronger and faster. The pulse, after continued use, is therefore somewhat stronger and faster.

Action on the secretory glands: Phosphorus sometimes increases the secretion of sweat.

Action on the sexual organs: Many preparations of phosphorus often increase the activity of the sexual organs.

Action on the kidney: The flow of urine is somewhat increased by phosphorus.

Excretion

Phosphorus is slowly excreted, mostly by the kidney, by the intestines and the sweat, and also by all the mucous membranes, especially those of the lungs.

Poisonous Effects

Phosphorus poisoning occurs in two forms: Acute phosphorus poisoning and chronic phosphorus poisoning.

Acute Phosphorus Poisoning

Acute phosphorus poisoning usually results from phosphorus taken with suicidal intent. The red phosphorus is usually more poisonous than the yellow phosphorus. Many pastes used to destroy vermin, or match heads which contain phosphorus, are the substances usually taken for this purpose.

The symptoms usually appear in about three to twelve hours after they are taken. If an oily solution, or a paste is taken, the symptoms appear more rapidly. If a solid preparation such as match heads are taken, the symptoms come on later.

Symptoms

Several hours after the phosphorus is taken, the patient complains of **pain in the stomach.** He has a **garlic taste in his mouth,** and a similar odor to the breath, and he feels nauseated. Soon the patient begins to **vomit continuously. The vomited matter** has a characteristic **garlic odor and emits light** when it is held in the dark (phosphoresces). Later the vomited matter contains bile. If the amount of phosphorus taken has not been very large, and has mostly been vomited, the nausea and vomiting may continue for several days, without any further symptoms.

Usually however, the symptoms return, but the vomited matter now contains blood, which is dark in color (coffee ground), the **patient becomes jaundiced** (yellow color of the skin), the pain spreads all over the abdomen, and the liver is enlarged. There is **profuse diarrhoea,** the stools often containing blood. There may also be **bleeding from the nose, from the uterus and under the skin.** The urine is often scanty and contains albumin.

The patient is usually in **severe collapse,** because of the profuse vomiting and diarrhoea. He feels weak and faint, the pulse is rapid, weak and thready, the breathing is slow and shallow, and the skin is cold and moist. He gradually **goes into coma and dies.** Occasionally there are convulsions and delirium before death.

Death from phosphorus poisoning has resulted from gr. $\frac{3}{4}$ to grs. ii in a few hours to a few weeks.

The characteristic symptoms of phosphorus poisoning are:

1. Nausea, vomiting and diarrhoea.
2. The vomitus and stools, as well as the urine emit light when held in the dark.
3. Jaundice.

All the symptoms of phosphorus poisoning are due to the destruction of many of the cells of the various organs of the body. The cell substances are destroyed, and changed into fat globules with which the cells are then filled. For example, the jaundice is due to the destroyed liver cells which block up the bile ducts in the liver, the bile is then secreted back into the blood. The vomiting and diarrhoea with bloody vomitus and bloody stools, are due to the destruction of the cells of the mucous membrane of the stomach and intestines.

Treatment

1. Give as an antidote, **old common crude turpentine** or, French acid turpentine, about 2.0 c.c. (3$\frac{1}{2}$) every fifteen minutes. This forms a hard solid mass with the phosphorus, and prevents its absorption.
2. Occasionally hydrogen peroxide, or potassium permanganate, may be given to oxidize the phosphorus.
3. Copper sulphate may be given to produce vomiting.

It is also an antidote, and is best given about two grains every five minutes, until vomiting is produced; and after that gr. ½ may be given every twenty minutes as long as ordered.

4. Wash out the stomach.

5. Give cathartics, especially salines such as hydrated magnesia.

6. Protect the mucous membrane with albuminous drinks as the white of egg, etc.

7. **Do not give oils or fats, as these hasten the absorption of the phosphorus.**

8. Treat the collapse with heart stimulants such as caffeine, strychnine, atropine, etc.

Chronic Phosphorus Poisoning

Chronic phosphorus poisoning usually occurs in individuals who work in phosphorus match factories, as a result of continually inhaling the phosphorus fumes. It occurs most frequently from the use of the yellow phosphorus, which has now mostly been given up, and the symptoms are therefore now rarely seen.

Symptoms

The symptoms usually begin with a carious tooth, or a sore gum. The gums become swollen and painful, abscesses of the jaw often form, with **destruction of pieces of the jaw bone.** Occasionally there may be **slight jaundice, anaemia, diarrhoea,** albumin in the urine, etc.

Treatment

Thorough ventilation of the factories where phosphorus is used, to get rid of the fumes, and the inhalation of the crude turpentine, usually prevents the condition.

The abscesses of the jaw which form, must be treated surgically.

Uses

Phosphorus preparations, are used:

1. In nervous diseases such as neurasthenia, and other similar diseases, to build up the nervous tissues.
2. To harden the bones in rickets, osteomalacia, etc.
3. To increase sexual activity.

Preparations

Phosphorus (Phosphorus) 0.0006–0.0012 gm. gr. $\frac{1}{100}-\frac{1}{60}$

Pills of Phosphorus (Pilulae Phosphori)

Each pill contains 0.0006 gm. (gr. $\frac{1}{100}$) of phosphorus.

Phosphorated Oil (Oleum Phosphori) 0.06 –0.3 c.c. m. i–v

This contains about 1% of phosphorus in almond oil and ether, and is occasionally used.

The following preparations are made from **phosphoric acid**; which is formed when phosphorus is burnt.

Dilute Phosphoric Acid (Acidum Phosphoricum Dilutum) 0.3–1.0 c.c. m. v–xv

This contains 10% of the pure phosphoric acid.

From the phosphoric acid the following salts are obtained:

Precipitated Calcium Phosphate (Calcii Phosphas Praecipitatus)

This is rarely given alone, but in the form of an emulsion of cod liver oil and lactophosphate of calcium. Each drachm contains gr. ii of calcium phosphate and $3\frac{1}{2}$ of cod liver oil.

Zinc Phosphide (Zinci Phosphidum) 0.003–0.03 gm. gr. $\frac{1}{20}-\frac{1}{2}$

The following preparations are made from **hypophosphorus acid**, which is never used of itself.

Calcium Hypophosphite (Calcii Hypophosphis) 1.0–2.0 gms. grs. xv–xxx

Iron Hypophosphite (Ferri Hypophosphis) 1.0–2.0 gms. grs. xv–xxx

Potassium Hypophosphite (Potassii Hypophosphis)	1.0–2.0 gms.	grs. xv–xxx
Sodium Hypophosphite (Sodii Hypophosphis)	1.0–2.0 gms.	grs. xv–xxx
Syrup of Hypophosphites (Syrupus Hypophosphitum)	4.0–8.0 c.c.	ʒi–ii

This contains the hypophosphite of calcium, sodium and potassium, also the tincture of lemon peel and sugar.

Compound Syrup of Hypophosphites (Syrupus Hypophosphitum Compositus)	4.0–8.0 c.c.	ʒi–ii

This contains iron hypophosphite in addition to the ingredients in the syrup of hypophosphite.

The following preparations are made from **glycerophosphoric acid:**

Calcium Glycerophosphate (Calcii Gylcerophosphas)	0.2–0.6 gm.	grs. iii–x

Various syrups and wines of glycerophosphates are on the market. Many of them are combined with iron. They are all good tonics.

GOLD (AURUM)

Gold is a heavy metal; some of its salts are occasionally used in medicine.

ACTION

When given internally gold salts produce the following effects.

1. They increase the appetite and aid digestion.
2. They lessen nervousness in neurasthenia, making the patient calm and quiet, by improving the nutrition of the brain.
3. They increase reflex action.
4. They increase the secretion of sweat.
5. They often increase the flow of urine.
6. Gold salts are said to increase menstruation, and sexual activity.

Poisonous Effects

Overdoses cause:

1. Abdominal pain.
2. Nausea, vomiting and diarrhoea, with bloody vomitus and bloody stools.
3. Collapse.

Continued use of gold salts often causes loss of appetite, poor digestion, and wasting.

Uses

Gold salts are principally used to lessen nervousness, in hysteria and neurasthenia, and as a substitute for mercury in the treatment of syphilis. It was formerly used in the treatment of the alcohol habit. The "Keely Cure" was a treatment of alcoholism with the bichloride of gold, a salt which does not exist.

Preparations

Gold and Sodium Chloride (Auri et Sodii Chloridum)	0.006 –0.03 gm. gr. $\frac{1}{10} - \frac{1}{2}$
Gold Chloride (Auri Chloridi)	0.0004 gm. gr. $\frac{1}{150}$
Gold and Potassium Bromide (Auri et Potassii Bromidum)	0.01–0.04 gm. gr. $\frac{1}{6} - \frac{2}{3}$

This is usually given hypodermically. The injections are painful and often cause pain around the heart.

CHAPTER XI

ALTERATIVES

Alteratives are drugs which improve the nutrition of the body, or various organs of the body. Their mode of action is unknown. They are said to improve the condition of the blood.

Drugs which improve the condition of the blood such as iron or arsenic, also thereby improve the nutrition of the body. The drugs which improve the nutrition of the nervous system also improve the nutrition of various parts of the body. Most of these drugs however, have other important actions and have been described under these effects.

The most important drugs which are occasionally used as alteratives are:

Mercury.

Gold.

Iodine and salts of hydriodic acid such as potassium iodide, sodium iodide, etc.

Arsenic.

The following drugs are rarely used, but when given, they are used only as alteratives.

SARSAPARILLA

Sarsaparilla is obtained from the roots of **Smilax officinalis,** and other varieties of smilax. It is a prickly vine obtained from Mexico, Honduras, Brazil and other countries in the northern part of South America. Its active principles are soapy glucosides (saponins). **Sarsaponin, sarsaparilla saponin, parillin** and **smilacin.** The amount of these glucosides however, is not sufficient to cause a marked effect.

ACTION

Sarsaparilla is used principally to improve the nutrition of the body (alterative). It is said to increase the perspiration. In large doses it causes vomiting and diarrhoea. It was formerly used a great deal in the treatment of the third stage of syphilis, chronic rheumatism, etc. It is occasionally used as a drink.

Preparations

Fluidextract of Sarsaparilla (Fluidextractum Sarsaparillae)	4.0 c.c.	ʒi
Compound Fluidextract of Sarsaparilla (Fluidextractum Sarsaparillae Compositus)	4.0–8.0 c.c.	ʒi–ii

This contains sarsaparilla, licorice root, sassafras and mezereum.

Compound Syrup of Sarsaparilla (Syrupus Sarsaparillae Compositus)	15.0–30.0 c.c.	ʒ½–i

This is used as an excellent vehicle in which to give potassium iodide.

GUIAC RESIN (GUIACUM RESINA)

Guiacum is the resin of the wood of **guiacum officinale** and **guiacum sanctum**, evergreen trees of South America.

ACTION

Guiac is said to improve the nutrition of the body, to increase the secretion of sweat and the mucous membranes.

Overdoses cause vomiting and diarrhoea.

It is occasionally used in syphilis, tonsilitis, and is often given to increase the menstruation.

Preparations

Tincture of Guiac (Tinctura Guiaci)	2.0–8.0 c.c.	ʒ½–ii

Ammoniated Tincture of Guiac 2.0–8.0 c.c. ʒ½–ii
(Tinctura Guiaci Ammoniata)

Both of these preparations are best given in milk.

MEZEREUM

Mezereum is obtained from the bark of **Daphne mezereum,** a European plant. Its active principles are **daphnin,** a bitter glucoside, and an acid resin.

Action

Applied locally: Mezereum causes redness, swelling, and inflammation of the skin and mucous membranes.

Internally: It increases the secretion of saliva, sweat and urine.

Poisonous Effects

Overdoses cause nausea, vomiting, profuse diarrhoea, together with severe collapse, which may cause death.

Uses

Mezereum is often applied on the skin in the form of the compound mustard liniment to produce redness. It is used internally as an alterative, in syphilis, etc.

Preparations

Fluidextract of Mezereum 0.6 c.c. **m. x**
(Fluidextractum Mezerei)

SASSAFRAS

Sassafras is obtained from the bark of the **Sassafras varifoliorum.** Its active principle is a volatile oil, the oil of sassafras.

ACTION

Sassafras is said to mildly improve the nutrition of the body (alterative). It also increases the sweat. It is often given together with sarsaparilla.

The oil of sassafras is used as a flavoring agent, and as a perfume.

Preparations

Oil of Sassafras (Oleum Sassafras)	0.06–0.3 c.c.	m. i–v

CALENDULA

Calendula is obtained from the dried flowers of **Calendula officinalis**, or marigold.

It is used to improve nutrition and to increase the sweat and flow of urine.

Preparations

Tincture of Calendula (Tinctura Calendulae)	2.0–4.0 c.c.	ʒ½–i

JAMBUL (not official)

Jambul is obtained from the bark of **Eugenia jambolana**, an East Indian tree.

ACTION

Jambul contracts mucous membranes, and increases the flow of urine. It is said to improve diabetes.

In India it is often used to check diarrhoea.

STILLIGIA

Stilligia is obtained from the **Stilligia sylvatica**, or queen's delight, an English plant.

ACTION

Stilligia slightly improves the nutrition of the body. It increases all the secretions, and is said to improve the heart action.

In overdoses it causes vomiting and diarrhoea. It is occasionally used in syphilis, chronic rheumatism, etc.

Preparations

Fluidextract of Stilligia (Fluidextractum Stilligiae)	2.0–4.0 c.c.	ʒ½–i

XANTHOXYLUM

Xanthoxylum is obtained from the bark of **xanthoxylum,** or prickly pear, an American tree.

ACTION

Xanthoxylum causes redness if applied locally. It is said to improve the nutrition of the body. It is often applied locally in pelvic diseases, together with tincture of capsicum.

Preparations

Fluidextract of Xanthoxylum (Fluidextractum Xanthoxylii)	2.0–4.0 c.c.	ʒ½–i

LAPPA

Lappa is obtained from the root of **Arctium lappa** or burdock, an American plant.

ACTION

Lappa improves the nutrition of the body. It is a laxative, and it slightly increases the flow of urine and the secretion of sweat.

Preparations

Fluidextract of Lappa (Fluidextractum Lappae)	1.0–4.0 c.c.	m. xv–ʒi

THIOSINAMINE (not official)

Thiosinamine is a crystalline, colorless substance made from the oil of mustard, by the action of an alcoholic solution of ammonia. Chemically, it is called allyl sulphocarbamide, allyl thiourea, or rhodaline.

ACTION

Thiosinamine softens and absorbs all kinds of scar tissue,

swellings of the lymph glands, and swellings resulting from chronic inflammations, in all the organs of the body.

Uses

Thiosinamine is used to remove scar tissue in the eye, the skin, the stomach, the urethra, etc.

Administration

It is used locally in the form of plasters or ointments containing 10% of thiosinamine.

It is usually given hypodermically however, in 10% or 15% solutions, and occasionally it is given by mouth in capsules.

Preparations

Thiosinamine (Thiosinamina)	0.03–0.1 gm.	gr. ½–i½

FIBROLYSIN (not official)

Fibrolysin is a salt made from thiosinamine. Chemically it is thiosinamine sodium salicylate.

Its action is the same as that of thiosinamine but it is more quickly absorbed.

It is given hypodermically, intramuscularly, or intravenously.

It usually comes in small glass vials, each containing 2.3 c.c. of fibrolysin, which is equivalent to 0.2 gm. (gr. iii) of thiosinamine.

MEDICINAL FOODS

The following substances are used to improve the general health and strength of the body and to build up the tissues. They are not drugs, but food substances which are very easily digested and assimilated. Many of them are predigested, and these are of particular value in patients with very poor digestion.

ACTION

All these medicinal foods improve the health and strength, by helping to build up the tissues. They are often given together with various tonics, such as iron, arsenic, phosphorus, etc.

The medicinal foods consist largely of one or other of the following food principles:

Proteids
Carbohydrates
Fats

Most of the preparations consist of one or a number of these food principles dissolved in alcohol, or glycerin, which serves only to preserve them.

PROTEID PREPARATIONS

Solid Preparations

CASOID DIABETIC FLOUR

This consists of 85% of proteids obtained from milk, About 1½% of fat, and about 3% of mineral substances, while the remainder is water.

It contains no carbohydrates, or starchy foods, and is used in diabetes, where starchy foods should not be given.

CIOSE

Ciose is a dry powder made from beef which contains about 85% of proteids. It has a great nutritive value and is added to broths, soups, etc. It is often given in wine.

SOMATOSE

Somatose is a powder which contains the proteids of meat in a very concentrated form. There are also preparations of somatose combined with iron and with milk.

SANATOGEN

Sanatogen is a powder consisting of sodium glycerophosphate combined with casein, one of the proteids of milk.

DRY PEPTONOIDS

Dry peptonoids is made by digesting beef, milk and wheat. The proteids of these foods are digested by pancreatin, and the carbohydrates, with malt diastase. It is given in doses of 8.0–16.0 c.c. (ʒii–ʒss) in water, milk, wine, broths, soup and gruels.

Liquid Preparations

MEAT JUICES

Meat juices are of two kinds:

1. **Cold meat juices.**
2. **Warm meat juices.**

COLD MEAT JUICE

Cold meat juice is made by finely chopping up lean meat from the round of beef, then expressing the juice from these pieces. This contains about 6% of the meat albumins and is very nutritious.

WARM MEAT JUICE

Warm meat juice is made by chopping up lean meat from the round of beef, expressing the pieces, and allowing them to remain in water in a warm place for about half an hour. There are numerous meat juices on the market made by various firms, such as Liebig's, Valentine's, etc.

MEAT EXTRACTS

The meat extracts contain very little proteids, and are not very nourishing. They contain mostly extractives, such as various salts, which make the patient feel better and increase the appetite. The most common beef extracts used are extracts made by various firms, beef teas and beef essences.

LIQUID PEPTONOIDS

Liquid peptonoids contains about 5% of proteids, and about 10% of carbohydrates, mainly various sugars. It is given in doses of 15.0–30.0 c.c. (℥½–i).

ENEMOSE

Enemose is a sterile liquid containing about 12% of proteids from beef and wheat, and about 45% of carbohydrates, mainly from wheat.

It is used principally for rectal feeding. It usually comes in vials, the contents of one vial being dissolved in four parts of water and given by rectum.

PEPTONE

Peptone is obtained by the artificial digestion of proteid substances such as meat. In large doses it is injurious to the tissues (irritating). It is given in pastilles in doses of 5.0 gms. It is also given in suppositories for rectal feeding, or it is given in enemas.

PANOPEPTON

Panopepton is prepared from beef and wheat by digesting them with pancreatin. The digested food is then dissolved in sherry wine. It is given in doses of 8.0–16.0 c.c. (℥ii–℥½).

NUTROSE

Nutrose is sodium caseinate, a salt obtained from casein, one of the proteids of milk. It is particularly valuable in

chronic wasting diseases such as cancer, tuberculosis, and in pneumonia and typhoid.

PREDIGESTED LIQUID FOOD

Predigested liquid food is prepared by artificially digesting lean meat and milk with pepsin and hydrochloric acid. It contains about 10% of proteids and about 10½% of carbohydrates.

GELATINE

Gelatine is an albumin like (albuminoid) substance derived from fibrous and cartilaginous tissue. It becomes solid when cool, and liquid when heated. It is an easily digested food. It helps to coagulate the blood, and is frequently used to check bleeding from the nose, the intestines, the kidney, etc.

It may be **applied locally** to the bleeding area or it is given internally.

Gelatine is frequently given hypodermically or in normal salt solution by means of a hypodermoclysis. The solution must be absolutely sterile, as tetanus occasionally results from unsterile gelatine because of the tetanus bacilli contained in it.

Internally it is given in doses of ʒi–ii, three or four times a day, or in the form of a jelly flavored to taste better.

Preparations

Gelatine (Gelatinum)	4.0–8.0 c.c.	ʒi–ii

Glycerinated Gelatine (Gelatinum Glycerinatum)

This is gelatine impregnated with an equal amount of glycerin.

MILK FOODS

The most important medicinal foods made from milk are **kumyss** and **matzoon.**

KUMYSS

Kumyss or koumiss, is a fermented liquid prepared from mare's milk by the Tartars, who originated it. It is made from cow's milk in this country by the fermentation of milk by yeast. Liquid yeast is added to the milk, and the resulting liquid is then allowed to stand for about eight to ten hours in a lukewarm place.

MATZOON

Matzoon, or kefir kumyss is made by fermenting milk with a kefir fungus, a fungus obtained from Caucasia in Russia. It is on the market under various names such as matzoon, zoolak, etc. There are numerous other preparations of milk made by growing bulgaric bacilli, which form lactic acid in the milk. They are principally used however, for the effect of the bulgaric bacilli which they contain and they will be considered under these preparations.

There are numerous other predigested foods which are very often used in weakened conditions. The most important ones are:

Peptonized milk gruels
Peptonized beef tea
Peptonized oysters
Pancreatized milk toast, etc., etc.

CARBOHYDRATE PREPARATIONS

DEXTROSE OR STARCH SUGAR

Dextrose is a sugar which is readily digested. It is used as a food instead of ordinary cane sugar. It is given in doses of 180.0 gms. (℥vi) daily.

LEVULOSE OR FRUIT SUGAR (DIABETIN)

Levulose is a sugar which is used to sweeten the food for diabetic patients who cannot take ordinary sugars.

PREPARATIONS OF FATS

COD LIVER OIL (OLEUM MORRHUAE)

Cod liver oil is obtained from the livers of various species of codfish, especially the **Gadus morrhua.**

It consists of the various fats, olein, stearin, and palmitin, and some fatty acids. It also contains very small quantities of iodine, chlorine, bromine, phosphorus, and other substances.

The livers were formerly left to decompose, and the oil which is thus formed was then gathered. By a recent method, the cod liver oil is obtained by forcing steam under pressure through the livers, and the oil is then obtained. This oil is pale in color and less nauseating than the oil formed by the old method. There are three varieties of cod liver oil, the dark, the light brown, and the pale yellow.

Cod liver oil was used for many years by the fishermen of the North Sea as a remedy for children's diseases. It is now very extensively used in medicine.

ACTION

Cod liver oil improves the general condition of the patient if given for some time. It increases the appetite, and it makes the patient stronger, stouter and healthier. Its effect depends largely upon the fats which it contains. It differs from ordinary fats taken in the food however, by being more easily digested, absorbed, and assimilated by the body. It is digested in the intestines, and is then deposited as fat in the various tissues and organs of the body, thereby building up the patient.

In overdoses it causes nausea, occasionally vomiting and diarrhoea.

Uses

Cod liver oil is given principally in "run down" conditions, and in chronic wasting diseases such as tuberculosis, etc. It is often given together with malt or creosote.

It is usually only given in winter because patients dislike it in the summer.

Administration

Cod liver oil has a very unpleasant odor and an extremely nauseous taste, which must be disguised when it is given.

The unpleasant taste and odor can be disguised in the following ways:

1. When given in brandy, wine, or lemon juice, in the same way as castor oil is given (see Castor Oil).
2. By taking a little peppermint, and then putting the cod liver oil in the mouth without allowing the lips to touch it, so that the smell does not reach the nose.
3. By giving the emulsions of cod liver oil which have a more pleasant taste. They should be fresh, however, as they spoil very easily.

All preparations of cod liver oil should be given about three quarters of an hour to an hour after meals, the time when the digestion is greatest.

In children, when it cannot be given by the mouth, it may be rubbed on the skin of the chest or abdomen before retiring, as it is readily absorbed from the skin.

Preparations

Cod Liver Oil (Oleum Morrhuae)	4.0–16.0 c.c.	ʒi–iv
Emulsion of Cod Liver Oil (Emulsum Olei Morrhuae)	4.0– 8.0 c.c.	ʒi–ii

This contains 50% of cod liver oil.

Emulsion of Cod Liver Oil with Hypophosphites (Emulsum Olei Morrhuae cum Hypophosphitibus)	4.0– 8.0 c.c.	ʒi–ii

There are numerous preparations of cod liver oil on the market combined with preparations of phosphorus, iron, etc.

LECITHIN

Lecithin is a phosphorized fat. It consists of the various salts of fatty acids such as oleic, stearic and palmitic acids combined with glycero phosphoric acid and various proteid

substances. It is present in large quantities in nervous tissues. It is also present in various foods, especially in egg yolk and many vegetable foods. For medicinal purposes, it is made from egg yolk.

ACTION

Lecithin increases the nutrition of the body, though it is not nourishing in itself. It increases the number of red blood corpuscles and the haemoglobin. It is used principally as a tonic.

It is given by the mouth in doses of 0.1–0.5 gm. (grs. i½–viii) in pills, or hypodermically in doses of 1.0 c.c. (m. xv), or in 15% solutions in oil.

Preparations

Lecithin Solution 4.0– c.c. ℥i
(Containing gr. i of lecithin.)

This is a 2% solution of lecithin in glycerin and alcohol. Its action and uses are the same as that of lecithin.

Lecithol 4.0 c.c. ℥i

It is a 2% emulsion of lecithin in alcohol. It is obtained from the brains of hogs.

Glycerole of Lecithin 4.0 c.c. ℥i
(Containing gr. i of lecithin.)

Lecibrin

This is obtained from the brains of animals and is combined with nucleoproteins. It contains 33% of lecithin. It comes in small gelatine coated "pepules," each containing grs. iii which is equivalent to about gr. $\frac{1}{25}$ of phosphorus.

Neuro Lecithin 0.1–0.5 gm. gr. i½–viii

This is a preparation of lecithin combined with small amounts of fats.

CHAPTER XII

SECRETORY STIMULANTS

Secretory stimulants are drugs whose principal action is to increase the secretions of the secretory glands.

PILOCARPUS OR JABORANDI

Pilocarpus or jaborandi is obtained from the leaves of the **Pilocarpus jaborandi,** or **Pilocarpus microphyllus,** a Brazilian shrub. Its active principle is an alkaloid **pilocarpine.** The preparations of pilocarpine, the alkaloid, are principally used.

Appearance of the Patient

About five to fifteen minutes after a dose of pilocarpine is given, all the secretions are increased. The patient sweats profusely, there is a profuse flow of saliva, of tears, and of mucous from the nose, mouth and bronchi. The face is flushed, the pupils are contracted, and the patient has difficulty in seeing distant objects. The breathing is faster, and the pulse is somewhat faster and weaker. Later the patient may have diarrhoea.

ACTION

Local action: Applied to the skin, pilocarpine produces no effects, but it is readily absorbed from such local applications. **On mucous membranes:** It is readily absorbed, but does not affect them locally. For example, the application of a drop of pilocarpine solution causes general effects.

Internal Action

In the mouth: Pilocarpus has a bitter taste. **It has an** odor resembling hay.

In the stomach: It increases the secretion of the mucous

membrane, and greatly increases the peristalsis of the stomach. In large doses it often causes nausea and vomiting.

In the intestines: Pilocarpine increases the secretion of the mucous membrane and the peristaltic contractions of the muscle wall. Frequent movements of the bowels therefore often result.

Action after Absorption

Pilocarpine is very rapidly absorbed into the blood from the stomach, and from all the mucous membranes upon which it is applied; usually in about fifteen minutes. After absorption it affects principally the secretory glands, the involuntary muscles, the pupil, the heart and respiration.

Action on the secretory glands: This is the most important effect of pilocarpine. **It increases the secretion of all the secretory glands,** except the breasts, the liver, and the kidneys.

The secretion of the sweat glands is greatly increased (diaphoretic action). It is used principally to produce this effect. The great activity of the sweat glands makes the skin very red. About ℥x–xv of sweat are secreted after one dose of pilocarpine, and the effect lasts for about three to five hours.

There is usually a profuse secretion of saliva, of tears, of mucus from the nose, and from the bronchi. The secretion of the mucous membrane of the stomach and intestines is also increased. The secretion of milk, bile and urine, however, is not affected.

The effect on the secretory glands is produced, by increasing the activities of the nerve endings for secretion in the various glands of the body. These nerve endings become more sensitive and they receive impulses for secretion more readily.

Action on the involuntary muscles: Pilocarpine increases the contractions of all the involuntary muscles, by increasing the activity of the nerve endings in these muscles, which then become more sensitive and receive impulses for the contraction of the muscles more readily.

The contractions of the involuntary muscles of the stom-

ach and intestines (peristalsis) are increased. The contractions of the involuntary muscles of the bronchi which pilocarpine produces, make the bronchi narrower, so that the patient must breathe faster and deeper to inhale a sufficient amount of air. The contractions of the involuntary muscles of the bladder, often cause frequent urination accompanied by straining.

The spleen and uterus are also contracted by pilocarpine.

Action on the pupil: Pilocarpine contracts the pupil. The effect on the pupil is due to the increased contractions of the involuntary circular muscles of the iris of the eye, which make the pupil smaller. The contractions of the ciliary muscle, make the lens more convex, so that the patient sees only near objects, and has great difficulty in seeing distant ones. Pilocarpine also makes the eyeball softer, by causing a free circulation of fluid from the posterior to the anterior chamber of the eyeball. It is often used to produce this effect in glaucoma, a disease where the eyeball becomes hardened and blindness often results.

Action on the circulation: Pilocarpine makes the heart beat slower and weaker. The pulse is therefore slow and weak. It makes the nerve endings in the heart, of the Vagus nerve, more sensitive; so that they receive more readily impulses to slow the heart. The pulse, however, may be somewhat stronger and faster for a few minutes.

Action on the respiration: The breathing becomes deeper and faster. This is due to the narrower bronchi which result from the contractions of their involuntary muscles, and the weakened heart action, which makes the blood accumulate in the lungs. The patient then has to breathe faster and deeper to get a sufficient amount of air in the lungs, with which to purify the blood.

Effect on temperature: The profuse sweating which pilocarpine produces, usually slightly lowers the temperature.

Excretion

Pilocarpine is excreted mainly by the kidneys and sweat. It begins to be eliminated in about an hour, and is entirely excreted in about twenty-four hours.

Dangers in the Use of Pilocarpine

Pilocarpine is a very efficient drug; but its use is limited by some of its effects, which are often injurious to the patient. These are:

1. The slow and weak pulse.
2. The profuse secretion of mucus in the bronchi fills up the lungs with mucus, and the contractions of the involuntary muscles of the bronchi make them narrower. The mucus is then expelled with difficulty, and the lungs fill up with fluid. This condition is known as **oedema of the lungs.** The patient is then said to "drown" in his own sweat.
3. Patients often feel very weak and chilly after pilocarpine.

Poisonous Effects

Since pilocarpine is rapidly excreted, only acute poisoning occurs, usually from an overdose.

Symptoms

1. Profuse secretion of saliva.
2. Profuse perspiration and flow of tears.
3. Occasionally, nausea, vomiting, abdominal pain and profuse diarrhoea, with watery stools.
4. Slow, irregular, weak pulse.
5. Rapid difficult breathing, accompanied by "râles" (gurgling sounds in the lungs, due to the accumulation of mucus).
6. Contracted pupils.
7. Occasionally dizziness, slight delirium, and twitchings of the muscles.

The breathing finally becomes slow and shallow, the patient complains of great weakness, and dies of failure of the respiration. He remains conscious to the end.

Treatment

1. Give atropine as an antidote. This paralyzes the nerve endings, which have been made more active by pilocarpine and neutralizes its effects.

2. Give artificial respiration if the breathing is slow and shallow.

3. Give heart stimulants such as caffeine, camphor, alcohol, etc.

Uses

1. Pilocarpine is used principally to increase the sweat, in cases of nephritis, when the patient secretes very little urine, and to remove fluid from the tissues (oedema) in this condition. The patient should be kept warm, wrapped up in blankets, to avoid unpleasant effects.

2. It is often given as a hair tonic, in some local applications. The hair is the secretion of the hair follicle, and the effect is probably due to the increased secretion of this, as well as of the other secretory glands, which pilocarpine produces.

3. It is often given to overcome dizziness resulting from lessened secretion in the labyrinth of the ear.

Preparations

Fluidextract of Pilocarpus (Fluidextractum Pilocarpi)	0.5 –2.0 c.c.	m. viii–xxx

Pilocarpine

Pilocarpine Hydrochloride (Pilocarpinae Hydrochloridum)	0.003–0.03 gm.	gr. $\frac{1}{20}$ – $\frac{1}{2}$
Pilocarpine Nitrate (Pilocarpinae Nitras)	0.003–0.03 gm.	gr. $\frac{1}{20}$ – $\frac{1}{2}$

Muscarine

Muscarine is an alkaloid, which is the poisonous principle of various poisonous mushrooms. It produces effects exactly like those of pilocarpine. The symptoms resulting from eating poisonous mushrooms are the same as those of pilocarpine poisoning.

EUPATORIUM (THOROUGHWORT)

Eupatorium is obtained from the leaves and flowers of the **Eupatorium perfoliatum**, boneset or thoroughwort.

It is used principally to increase the perspiration. It is given as an infusion, very hot; a tumblerful at a time. The patient should be in bed, warmly covered.

OTHER DIAPHORETICS

There are a number of drugs which increase the secretion of the secretory glands, especially the sweat glands, but they produce other more important effects. The most common ones are:

Ipecac (especially in the form of Dover's powder)
Antimony
Aconite
Veratrum Viride
Spiritus Aetheris Nitrosi (sweet spirits of niter)

Many of the saline diuretics, such as

Potassium Citrate
Solution of Ammonium Acetate
Spirit of Mindererus

Most of the salicylic acid preparations also increase the perspiration.

Eunatrol (non-official) 1.0 gm. grs. xv

This is sodium oleate. It is said to increase the flow of bile.

DRUGS WHICH INCREASE THE ACTION OF THE INVOLUNTARY MUSCLES

PHYSOSTIGMA AND ESERINE

Physostigma is obtained from the **Physostigma venenosum,** the calabar bean, or ordeal bean. It is a large bean, growing on a vine, principally in Calabar, on the western coast of Africa.

Its active principle is an alkaloid, **eserine, or physostigmine.** It contains two other alkaloids, calabarine, and eseridine.

The calabar bean has been used for generations by the natives of the Western Coast of Africa, as a test in the trials by ordeal for various crimes, such as witchcraft, etc. The accused individual is forced to eat the bean; if he is guilty, he dies, otherwise he is innocent!

Appearance of the Patient

About fifteen minutes after giving a dose of eserine, the patient usually complains of cramp-like pains in the abdomen and slight weakness. He often feels somewhat nauseated and the bowels move very freely; the stools being quite fluid. There is usually a profuse secretion of saliva, and perspiration.

The pulse is slow and weak, and the breathing is at first somewhat rapid and deep, but later it becomes slow and shallow. The pupils are contracted, and the patient is unable to see distant objects clearly, and usually complains of weakness.

ACTION

The action of physostigma is due to the eserine which it contains. This is the preparation which is commonly used. The effects of eserine, are quite similar to those of pilocarpine.

Local action: Applied to the skin, or mucous membranes, it produces no effects; but the drug is readily absorbed from mucous membranes.

Internal Action

In the mouth: No effects are produced.

In the stomach and intestines: It increases the secretions of the mucous membranes, and it increases the peristalsis very markedly, much more so than pilocarpine does. Cramp-like abdominal pains with frequent fluid stools are often produced by eserine.

Action after Absorption

Eserine is very rapidly absorbed into the blood from the stomach, in about fifteen minutes to a half hour. After absorption it affects principally the involuntary muscles, the pupil, the secretory glands, the circulation and the respiration.

Action on the involuntary muscles: Eserine increases the contractions of all the involuntary muscles, by increasing the activity of the nerve endings in the muscle wall. These nerve endings then become more sensitive, and receive impulses for contraction of the muscles more readily.

The muscles of the intestines are particularly affected, the peristalsis is very much increased, and frequent fluid movements of the bowels result. The contractions of the muscles of the ureter, bladder and uterus, are also increased.

Action on the pupils: It contracts the pupil if applied locally to the conjunctiva, or when given internally. It makes the nerve endings of the circular muscles of the iris more sensitive, so that impulses for their contractions are more readily received.

Eserine also contracts the ciliary muscle of the eye, which holds the lens in place. The contraction of this muscle makes the lens more convex, so that the patient is unable to see distant objects clearly. It also causes a free circulation of fluids from the posterior to the anterior chamber of the eye, thereby making the eyeball softer. Eserine is often used to produce this effect in glaucoma, a disease where the eyeball becomes hardened, and which often results in blindness.

Action on the secretory glands: Eserine increases the

secretion of all the secretory glands, by making their nerve endings more sensitive to receive impulses for secretion.

The secretion of saliva, mucus from the nose and bronchi; the tears, perspiration, the pancreatic, the stomach and intestinal secretions are all increased.

Action on the circulation: On the heart, eserine makes the heart beat slower, by making the nerve endings of the Vagus nerves in the heart, more sensitive to receive impulses which slow the heart.

On the blood vessels: The contractions of the involuntary muscle fibers in the walls of the blood vessels make them narrower. The blood pressure is thus raised; usually, however, this effect is not very marked. **The pulse of eserine is therefore slow and strong.**

Action on the respiration: Eserine makes the breathing slow and shallow, by lessening the activity of the respiratory center in the medulla, so that fewer impulses for breathing are sent out. Very often the breathing may be somewhat rapid at first.

Action on the spinal cord: It lessens the reflex action of the medulla on spinal cord.

Excretion

Eserine is very rapidly eliminated from the body by the urine and also by all the secretions. It begins to be excreted in a few minutes, and is entirely excreted in a few hours.

Poisonous Effects

Since eserine is very rapidly excreted, only acute poisoning occurs; usually from an overdose of the drug, given hypodermically or when dropped into the eye.

Symptoms

1. Abdominal pain.
2. Nausea and vomiting.
3. Diarrhoea, with frequent watery stools.
4. Excessive flow of saliva and perspiration.
5. Slow, shallow, difficult breathing.
6. Slow, irregular, weak pulse.

7. Contracted pupils.

8. Twitchings of the muscles, great muscular weakness and dizziness.

9. Collapse.

Treatment

1. Wash out the stomach.

2. Keep the patient warm.

3. Give artificial respiration.

4. Give atropine hypodermically. This is the antidote; as it paralyzes the overacting nerve endings, and increases the breathing.

5. Treat the collapse, with heart stimulants; such as alcohol, camphor, etc.

Uses

Eserine is principally used:

1. To soften the eyeball, in glaucoma and to contract the pupil.

2. To increase the peristalsis, to cause frequent movements of the bowels, and to expel gas. It is frequently used to produce this effect on patients that have just been operated upon, and who have difficulty in passing gas; especially after gynecological operations. It must never be given when the operation has been performed upon the stomach or intestines.

3. It is occasionally used in chronic constipation.

Preparations

Physostigma

Extract of Physostigma (Extractum Physostigmatis)	0.015–0.06 gm.	gr. ¼–i
Tincture of Physostigma (Tinctura Physostigmatis)	1.0–3.0c.c.	m. xv–xlv

Eserine

Eserine Salicylate (Physostigminae Salicylas)	0.001–0.003 gm.	gr. $\frac{1}{60}$–$\frac{1}{20}$
Eserine Sulphate (Physostigminae Sulphas)	0.001–0.003 gm.	gr. $\frac{1}{60}$–$\frac{1}{20}$

CHAPTER XIII

UTERINE STIMULANTS

The following group of drugs increase the contractions of the uterus. They are divided into two classes.

Oxytocics
Emmenagogues

Oxytocics are drugs which are used to contract the uterus, and expel its contents.

Emmenagogues are drugs which are used to increase, or to cause menstruation, when its absence is due to other causes than pregnancy.

When these drugs are used to bring about menstruation in pregnancy, they may be injurious; because they must be given in poisonous doses to produce this effect. Serious and even dangerous symptoms may then result, such as excessive bleeding, sepsis, etc.

OXYTOCICS

ERGOT (ERGOTA)

Ergot is a black parasitic fungus, which grows on the rye plant **Secale cereale**, the fungus taking the place of the rye grain. It is a very complex substance, and varies in its activity. It is said to consist of three active substances. **cornutine**, an alkaloid; **sphacelotoxin**, a resinous substance which resembles the sapotoxins, or soapy glucosides, in its effects; and **ergotinic acid.**

Each one of these substances produces some of the effects of ergot; but none of them can really be said to be the active principle.

It has recently been claimed that a newly discovered

alkaloid in ergot, **ergotoxine**, is the active principle. It causes the same effects produced by ergot.

Appearance of the Patient

Ergot is usually given to patients for bleeding from the uterus, or immediately after the birth of a child.

Within fifteen minutes to a half hour after a dose of a preparation of ergot is given, the patient usually complains of violent cramp-like pains in the lower part of the abdomen, particularly in the region of the uterus. If there has been bleeding from the uterus, this gradually becomes diminished.

The patient feels nauseated when it is given, and frequent movements of the bowels may result soon after.

It usually makes the pulse slow and strong.

ACTION

Local action: Ergot produces no effect on the skin. If it is given hypodermically, it is quite injurious to the tissues, and is apt to cause an abscess at the site of injection. **On mucous membranes:** It causes redness and swelling, with profuse secretion of mucus.

Internal Action

In the mouth: Ergot has a very unpleasant taste; it often increases the flow of saliva because of the redness of the mucous membrane of the mouth which it causes.

In the stomach: It increases the secretion of the mucous membrane, and the contractions of its muscle wall. It therefore often causes nausea and vomiting.

In the intestines: The secretions of the mucous membrane, and the contractions of the muscle wall of the intestines, are both greatly increased by ergot. This often causes frequent movements of the bowels, accompanied by griping pains.

Action after Absorption

Ergot is rapidly absorbed into the blood through the mucous membrane of the stomach. Its effects usually appear within a half hour. After absorption it affects prin-

cipally the uterus, the involuntary muscles and the circulation.

Action on the uterus: This is the most important action of ergot. **Ergot increases the contractions of the uterus.** It produces wavelike contractions of the uterine muscles, which expel the contents of the uterus. It does not always start uterine contractions, but it always increases them when they are once started. By contracting the uterus, ergot closes its blood vessels and stops uterine bleeding.

Action on the involuntary muscles: It increases the contraction of all the involuntary muscles, especially the small muscle fibers in the walls of the blood vessels, and the muscles of the stomach and intestines.

Action on the circulation: On the heart, ergot makes the heart beat slower by increasing the impulses which slow the heart, sent out from the Vagus or inhibitory center in the medulla of the brain.

On the blood vessels: The blood vessels are made narrower, by the contractions of the small muscle fibers in their walls, and by the greater number of impulses reaching these fibers from the vaso-constrictor center in the medulla. The narrow blood vessels increase the blood pressure, and offer a greater resistance to the contractions of the heart, which then contracts stronger.

The **pulse** of ergot is therefore **slow and strong.**

Action on secretions: The secretion of sweat and milk is lessened.

Excretion

The exact mode of excretion of ergot is unknown, but it is probably eliminated by the bowels and kidneys.

Cornutine

The slow pulse, nausea, vomiting and diarrhoea are caused by the cornutin; which increases the activity of various centers in the medulla oblongata, especially the Vagus center and the vaso-constrictor center.

Sphacelotoxin

The uterine contractions, and the contractions of the

muscle fibers in the walls of the blood vessels, are produced by sphacelotoxin, which increases the contractions of all the involuntary muscles.

Poisonous Effects

There are two forms of ergot poisoning, acute poisoning and chronic poisoning.

Acute Ergot Poisoning

Acute ergot poisoning is very rare and usually occurs from large doses of ergot, taken to produce abortion.

Symptoms

1. Cramp-like abdominal pain.
2. Vomiting.
3. Diarrhoea.
4. Unquenchable thirst.
5. Bleeding from the uterus.
6. Abortion.
7. Jaundice.
8. Haemorrhages into the skin.
9. Tingling and itching of the skin.
10. Collapse (rapid, weak pulse, cold skin, slow and shallow breathing, etc.).

There may be convulsions before death.

Treatment

1. Wash out the stomach.
2. Treat the collapse with heart stimulants; such as caffeine, strychnine, etc.

Chronic Ergot Poisoning

Chronic ergot poisoning results from eating rye bread, made from rye which has been infected with the ergot fungus. This is more apt to occur in the rye growing during wet seasons.

Ergot poisoning is very common in Russia and other northern countries, where a good deal of rye bread is eaten.

In the mediæval ages plagues of ergot poisoning were quite common.

There are two forms of chronic ergot poisoning.

1. **The Gangrenous form**
2. **The Spasmodic form**

In some epidemics the gangrenous form, and in others the spasmodic form predominates.

Gangrenous Form

This is due principally to sphacelotoxin, which contracts the blood vessels so much, that the circulation of various parts of the body is cut off, and the part affected then dies, or becomes gangrenous.

Symptoms

The limbs are first affected. **The fingers and toes become cold,** they lose their sensation, and become blue in color. **Soon they become hard and shriveled up and fall off;** without any pain. Sometimes the gangrene spreads up over the extremities, and the forearm or leg may become gangrenous and fall off. Sometimes the internal organs become gangrenous in this way. **Ulcers in the stomach and intestines** then frequently occur, because the circulation of various areas of these organs is cut off. **Ulcers of the cornea** of the eye often result because its circulation is cut off.

Nervous or Spasmodic Form

This is due to cornutine, which causes increased activity of the brain. The brain soon becomes exhausted, however, so that symptoms of lessened activity, or depression, result.

Symptoms

1. Weakness.
2. Drowsiness.
3. Headache.
4. Dizziness.
5. Itching, and a feeling as if something were creeping over the limbs (formication).

6. Painful cramps in the limbs.

7. Clonic convulsions, followed by epileptiform convulsions.

The mind remains clear after the attacks, but often the patient becomes insane.

The treatment depends upon the various symptoms which occur.

Uses

Ergot is used to contract the uterus, to prevent or check uterine bleeding. It should always be given when the uterus is empty.

In labor cases it should always be given after the third stage of labor, that is, after the birth of the placenta. If ergot is given before the placenta is entirely expelled, the contractions of the uterus may cause pieces of the placenta to remain in the uterus, which may then become infected and cause sepsis.

Ergot is frequently given to check bleeding from the lungs, from an ulcer of the stomach, from an ulcer of the intestines in typhoid fever, etc. The bleeding is checked by the contractions of the bleeding vessels.

Administration

Ergot has a very unpleasant taste which should always be disguised. It is best given after meals.

When given hypodermically, it should be injected deep into the muscles, and the part should then be massaged very thoroughly.

Preparations

Fluidextract of Ergot (Fluidextractum Ergotae)	4.0–8.0 c.c.	ʒ i–ii
Wine of Ergot (Vinum Ergotae)	10.0–20.0 c.c.	ʒ ii½–v

This contains about 20% of ergot.

Ergot preparations change very readily, if kept for any length of time. They may then be entirely inactive.

There are a number of preparations of ergot on the market

which are suitable for hypodermic use. There are other preparations which are not so nauseating and are more reliable than the usual preparations. Most of them are not official.

New and Non-official Preparations

Purified Extract of Ergot: 0.2–0.5 gm. grs. iii–viii
Extractum Ergotae Purificatum
(Bonjean's Ergotin)

This is a purified extract of ergot about ten times as strong as ergot itself. It is often given hypodermically.

Ergotole 0.3 2.0 c.c. m. v–xxx

This is an excellent preparation made from specially cultivated Spanish ergot. It is about 2½ times as strong as the fluidextract. It is suitable for hypodermic use.

Ernutin 2.0–4.0 c.c. m. xxx–ʒ i

This has a pleasant taste, and is a reliable preparation of ergot. It is also given hypodermically in doses of 0.3–0.6 c.c. (m. v–x).

Ergotoxin 0.0006–0.0012 gm. gr. $\frac{1}{100}$–$\frac{1}{50}$

This is said to be the active principle of ergot and is given hypodermically.

Ergotonine Citrate 0.0006–0.0012 gm. gr. $\frac{1}{100}$–$\frac{1}{50}$
(Ergotoninae Citras)

This is an alkaloid, which is changed in the body to ergotoxine.

Cornutol	hypodermically	0.6–2.0 c.c.	m. x–xxx
	by mouth	0.6–4.0 c.c.	m.x–ʒi

(Liquid Extractum Ergotae)

This is a preparation of ergot which has been tested and found to be reliable.

HYDRASTIS (GOLDEN SEAL)

Hydrastis is obtained from the roots and underground stems of **Hydrastis canadensis,** golden seal or yellow root. It

is a small shrub growing in the United States. Its active principles are the alkaloids, **hydrastine** and **berberine.**

Appearance of the Patient

After giving hydrastis, or any of its alkaloids, the patient usually has a better appetite, and the bowels move more freely. If there has been bleeding from the uterus, this is gradually checked. The pulse is slow and strong.

ACTION

Local action: On the skin, hydrastis has no effect. **Applied to mucous membranes:** It increases their secretions.

Internal Action

In the mouth: It has a bitter taste and increases the flow of saliva.

In the stomach: It increases the appetite, and aids digestion by increasing the secretion of gastric juice, and the peristalsis of the muscle wall of the stomach.

In the intestines: It increases the secretion and peristalsis, causing frequent movements of the bowels.

Action after Absorption

Hydrastis is slowly absorbed into the blood, mainly through the intestinal mucous membrane. After absorption, it affects principally the circulation, the involuntary muscles, especially the muscle fibers in the walls of the blood vessels, and the uterus.

Action on the circulation: On the heart, hydrastis makes the heart beat slower, by increasing the impulses which slow the heart, that are sent out from the medulla of the brain.

On the blood vessels: It makes the blood vessels narrower by contracting the muscle fibers in their walls. This increases the blood pressure and helps to make the heart beat stronger.

The total effect on the circulation is to make the heart

beat slower and stronger, which causes a **slow and strong pulse.**

Action on the uterus: Hydrastis contracts the uterus. By this effect, and the contractions of the uterine blood vessels which it causes, it checks bleeding from the uterus.

Action on the involuntary muscles: It contracts all the involuntary muscles, such as those of the intestines, of the iris, as well as those of the blood vessels.

Hydrastis is said to increase the secretion of bile.

Excretion

Hydrastis and its alkaloids are mainly eliminated from the body by the kidneys. It is excreted very slowly, much slower than it is absorbed, so that cumulative symptoms often result from continual administration.

Hydrastine

The slow, strong pulse, the contractions of the blood vessels, the contractions of the uterus, and other involuntary muscles, are due to the action of **hydrastine.**

Berberine

The increased appetite, the increased secretions of the stomach and intestines are due to berberine; which is a simple bitter. This alkaloid is often found in many other plants used as simple bitters.

Poisonous Effects

Poisoning from hydrastis or from its alkaloids is extremely rare. In the few cases that have occurred the symptoms were,

1. Vomiting.
2. Headache.
3. Dizziness.
4. Difficult breathing.
5. Slow, weak, irregular pulse.
6. Convulsions.
7. Collapse, and death from failure of breathing.

Uses

Hydrastis is used:

1. As a bitter, to increase the appetite and aid digestion by increasing the secretion of the gastric juice.
2. To check uterine bleeding.
3. For constipation, to make the stools more fluid in character.

Preparations

Fluidextract of Hydrastis (Fluidextractum Hydrastis)	1.0–4.0 c.c.	m. xv–ʒi
Tincture of Hydrastis (Tinctura Hydrastis)	1.0–4.0 c.c.	m. xv–ʒi
Glycerite of Hydrastis (Glyceritum Hydrastis)	1.0–4.0 c.c.	m. xv–ʒi

This is used principally to improve inflammations of the mucous membrane.

Hydrastine is rarely used, but an artificial alkaloid made from it, hydrastinine, is very frequently used.

HYDRASTININE

Hydrastinine is an artificial alkaloid made by oxidizing hydrastine.

It produces the same effect as hydrastis, but it is more efficient and its effects are more lasting.

ACTION

It contracts the uterus and the blood vessels very markedly. The blood pressure is very much increased after hydrastinine. It is used to check uterine bleeding.

Preparations

Hydrastinine Hydrochloride (Hydrastininae Hydrochloridum)	0.03–0.1 gm.	gr. ½–ii

It is given hypodermically in solution, and by the mouth in pills or tablets.

STYPTICIN (COTARNINE HYDROCHLORIDE)

(not official)

Cotarnine hydrochloride, or stypticin, is an artificial alkaloid, made by oxidizing narcotine, one of the alkaloids of opium.

ACTION

It contracts the blood vessels, and the uterus.

It is principally used to check bleeding from the uterus. It is also used to check bleeding from other parts of the body, such as the lungs, the stomach, or the intestines, by contracting the blood vessels of these organs. Gauze soaked in cotarnine is very frequently used by dentists to check bleeding.

Preparations

Cotarnine Hydrochloride (Stypticin) 0.015–0.1 gm. grs. ¼–ii
(Cotarninae Hydrochloridum)

It is given hypodermically in solution, or by the mouth in pills or tablets.

Cotarnine Phthalate (Styptol)
(Cotarninae Phthalas)

Hypodermically 0.2 gm. (grs. iii) dissolved in 2.0 c.c. (m. xxx) of water.

By mouth, 3 to 5 tablets a day. Each tablet contains gr. ⅜ of the drug.

PITUITARY EXTRACTS (not official)

Pituitary extracts or pituitrin, is an extract of a small gland, situated at the base of the brain. It causes marked contractions of the uterus in about half an hour after it is given. The contractions usually last for several hours.

It is used to check bleeding from the uterus and to cause uterine contractions after labor.

These substances produce other more important effects, which will be considered later. (See page 626.)

Administration

Pituitary Extract, or pituitrin, should be given hypodermically, as these substances are apt to be digested by the stomach.

Preparations

Pituitrin	1.0 c.c.	m. xv
In small glass vials, for hypodermic use.		
Pituitary Extract	1.0 c.c.	m. xv
In small glass vials.		
TYRAMINE	0.02 gm.	gr. $1\frac{1}{3}$

This is a chemical substance, which is used to contract the uterus and increase the blood pressure.

GOSSYPIUM (COTTON ROOT BARK)

Gossypium cortex is the dried bark of the ordinary cotton plant, **Gossypium herbaceum.**

It has been used by the southern negroes to produce abortion. It is occasionally used as a substitute for ergot to contract the uterus and to check uterine bleeding.

Preparations

Gossypii Cortex	2.0 gms.	grs. xxx

QUININE

Quinine is used to increase uterine contractions. It has other more important actions however, under which it will be described.

EMMENAGOGUES

Emmenagogues are drugs which increase menstruation.

SABINA (SAVINE)

Savine is obtained from the dried top of the **Juniperus sabina,** an evergreen shrub of Southern Europe, and eastern

countries. Its active principle is a volatile oil, resembling turpentine.

ACTION

Local action: Applied to the skin, or mucous membrane, it causes pain, redness and swelling, and on mucous membranes increased secretions.

Internal Action

In the mouth: It causes redness and secretion of saliva.

In the stomach and intestines: It increases the secretion of the mucous membrane and the peristalsis of the muscle walls.

Nausea, vomiting and diarrhoea often occur as a result of this action.

Action after Absorption

Savine is rapidly absorbed from the stomach. After absorption it affects the heart, the uterus and the kidneys.

Action on the heart: It makes the heart beat stronger and faster, causing a rapid, strong pulse.

Action on the uterus: Savine increases the contractions of the uterus, and the menstrual flow. It is often taken to produce abortion; but it is a dangerous drug, and may cause severe poisonous symptoms.

Action on the kidney: Savine increases the flow of urine.

Excretion

It is eliminated from the body mainly in the urine.

Poisonous Effects

Acute savine poisoning usually results from large doses of savine taken to produce abortion.

Symptoms

1. Violent abdominal pain.
2. Nausea and vomiting.
3. Profuse diarrhoea, with bloody stools.
4. Abortion.

5. Scanty urine.
6. Difficult breathing.
7. Twitchings of the muscles, and convulsions.
8. Collapse (rapid, thready pulse; slow, shallow breathing; cold, moist skin, etc.).

Treatment

1. Wash out the stomach.
2. Treat the collapse with heart stimulants.

Uses

Savine is used to increase menstruation, when its absence is not due to pregnancy.

Preparations

Fluidextract of Savine (Fluidextractum Sabinae)	0.3–1.0 c.c.	m. v–xv
Oil of Savine (Oleum Sabinae)	0.3–0.6 c.c.	m. v–x

RUE (RUTA)

Rue is obtained from the leaves of the **Ruta graveolens**, or garden rue. Its active principle is a volatile oil.

ACTION

Its action is similar to that of savine; but it is not as dangerous. It is used to increase menstruation, when its absence is not due to pregnancy. It is occasionally taken to produce abortion, and it then often causes poisonous symptoms.

Preparations

Oil of Rue (Oleum Rutae)	0.06–0.2 c.c.	m. i–iii

TANSY (TANACETUM) (not official)

Tanacetum or tansy is obtained from the leaves and tops of the ordinary garden tansy, **Tanacetum vulgare.** Its active principle is a volatile oil.

ACTION

Local action: Applied to the skin or mucous membranes, it causes redness and swelling with profuse secretion from the mucous membranes.

Internal Action

In the stomach and intestines: It causes redness, swelling and increased secretion (irritation) with increased peristalsis. Nausea, vomiting and diarrhoea often result from this action.

Action after Absorption

Tansy is absorbed into the blood from the stomach. After absorption it affects principally the uterus and the kidney.

Action on the uterus: Tansy increases the contractions of the uterus and increases the menstrual flow.

Action on the kidney: It increases the flow of urine.

Excretion

Tansy is eliminated from the body mainly by the kidneys.

Poisonous Effects

Poisonous symptoms usually result from large doses of tansy or tansy tea taken to produce abortion.

Symptoms

1. Violent abdominal pain.
2. Vomiting and diarrhoea with bloody stools.
3. Abortion.
4. Scanty bloody urine.
5. Convulsions.
6. Unconsciousness.
7. Collapse.

Death usually results from paralysis of the respiration.

Treatment

1. Wash out the stomach.

2. Treat the collapse with heart stimulants, such as caffeine, atropine, strychnine, etc.

3. For the convulsions give inhalations of chloroform.

Preparations

Oil of Tansy (Oleum Tanaceti)	0.06 c.c.	m. i
Infusion of Tansy (Infusum Tanaceti)		

This infusion contains 0.6–1.6 gms. (grs. x–xxv) of tansy.

OIL OF PENNYROYAL (OLEUM HEDEOMAE)

The oil of pennyroyal is a volatile oil obtained from the leaves and tops of **Hedeoma pulegioides**, or the pennyroyal plant.

It is used to expel gas from the intestine and to increase the menstrual flow. It is not a very active drug, but it is commonly used as a household remedy.

Preparations

Oil of Pennyroyal (Oleum Hedeomae)	0.06–0.3 c.c.	m. i–v

APIOL

Apiol is an oily liquid (a stearoptene), obtained from the root of ordinary garden parsley or **Apium petrosinellum.** It resembles camphor and is often called parsley camphor. Its active principle is said to be a substance called **apioline.**

Apiol is used to increase the menstrual flow, especially when the scanty menstruation is due to anaemia and when the menstruation is painful.

Preparations

Apiol	0.2–0.6 gm.	grs. iii–x
Apioline	0.2–0.5 gm.	grs. iii–viii

Apiol is given in capsules; most of which are imported

from France. Each capsule contains 0.25 gm. (grs. iv). There are a number of preparations of apiol combined with ergot and other substances.

Other substances used as emmenagogues are cantharides, guiac, etc.

CHAPTER XIV

DIURETICS

Diuretics are drugs which increase the flow of urine.

They may be classified in two groups; indirect and direct diuretics.

Indirect diuretics are drugs which increase the flow of urine, by improving the circulation of the kidneys. In this way the kidneys are supplied with more blood from which to secrete urine.

Direct diuretics are drugs which increase the flow of urine by directly increasing the activity of the kidney cells.

Diuretics may also be classified according to their chemical nature; such as saline diuretics, alkaline diuretics, vegetable diuretics, etc.

INDIRECT DIURETICS

The following drugs increase the flow of urine by improving the circulation of the kidneys. They make the heart beat stronger so that the blood is kept circulating more freely. More blood is therefore brought to the kidney more frequently, and the kidneys are then better able to manufacture urine. Thus the secretion of urine is increased.

The most important indirect diuretics are:

Digitalis
Strophantis
Squills
Apocynum

These drugs are used as heart stimulants, and their effects are described under that group.

DIRECT DIURETICS

THEOBROMA (THEOBROMINE) AND DIURETIN

Theobromine is a white powder, an alkaloid, obtained from the seeds of the **Theobroma cacao**, the chocolate tree of South America. It is very closely related, chemically, to caffeine. Its action is similar to that of caffeine.

ACTION

Local action: Theobromine has no effect when applied either to the skin or on mucous membranes.

Internal Action

In the mouth: It has a somewhat bitter taste.

In the stomach and intestines: It increases the secretions and peristalsis; often causing nausea, vomiting and frequent movements of the bowels.

Action after Absorption

Theobromine and its salts are rapidly absorbed from the stomach; usually in about a half to one hour. After absorption, it affects principally the heart, the muscles and the kidney.

Action on the heart: It makes the heart beat stronger and faster. It also contracts the blood vessels. The pulse is therefore stronger and faster.

Action on the muscles: Theobromine increases the contractions of all the muscles.

Action on the kidneys: Theobromine and its salts are excellent diuretics. **They increase the flow of urine,** by directly increasing the activity of the kidney cells. In this way, they remove fluid from the tissues; relieving oedema of the extremities, and fluid in the abdomen (ascites).

Excretion

Theobromine and its salts are rapidly eliminated from the body mainly by the kidneys; usually in a few hours.

Poisonous Effects

Since theobromine is rapidly excreted, it very rarely produces poisonous effects. When poisonous symptoms do occur, they are the same as those produced by caffeine.

Administration

Since theobromine and its salts are rapidly eliminated, they are best given in small doses, frequently repeated (about every two hours), when a continual effect is desired.

Preparations

All these preparations are not official.

Theobromine 0.3–1.0 gm. grs. v–xv
(Theobromina)

This preparation is apt to upset the stomach.

Theobromine Sodium Salicylate 0.3–1.0 gm. grs. v–xv
(Theobrominae Sodii Salicylas)
(Diuretin)

This preparation is very frequently given as a diuretic, because it is more readily dissolved than the others.

Theobromine Sodium Acetate 0.3–1.0 gm. grs. v–xv
(Theobrominae Sodii Acetas)
(Agurin)

Theobromine and Lithium Benzoate 0.3–1.0 gm. grs. v–xv
(Theobrominae et Lithii Benzoas)
(Urophen B)

Theobromine and Lithium Salicylate 0.3–1.0 gm. grs. v–xv
(Theobrominae et Lithii Salicylas)
(Urophen S)

CAFFEINE

Caffeine is an excellent diuretic. It increases the flow of urine by directly increasing the activity of the kidney cells.

THEOPHYLLIN

Theophyllin is the active principle of tea leaves. Its action is similar to that of caffeine. It is occasionally used to increase the flow of urine.

Preparations

Theophyllin Sodium Acetate (Theophyllinae Sodii Acetas)	0.2–0.3 gm.	grs. iii–v

THEOCIN

Theocin is artificial theophyllin. It is used to increase the flow of urine.

Preparations

Theocin (Theocinae)	0.2–0.3 gm.	grs. iii–v

VEGETABLE DIURETICS

The following drugs are obtained from various plants and act as diuretics.

SCOPARIUS (BROOM TOPS)

Scoparius is obtained from the dried tops of the **Cytisus scoparius,** or common broom plant which grows in Europe and the United States. Its active principles are, a fluid alkaloid **sparteine,** and a neutral substance **scoparin.** Its diuretic action is due to the scoparin.

ACTION

The principal action of scoparius is to increase the flow of urine, but its effect is not very marked, however.

Preparations

Scoparius is given in the form of a decoction, made by boiling about 15.0 gms. (℥ss) of broom tops in water to make up 250.0 c.c. (½ pint). Of this, about 30.0 gms. (℥i) is given every 2 or 3 hours.

Sparteine, the alkaloid of scoparius, lessens the contractions of involuntary muscles and weakens the heart action. It will be described more fully under these more important effects.

TARAXACUM

Taraxacum is obtained from the root of the **Taraxacum officinale,** or ordinary dandelion. Its active principles are two neutral bitter substances **taraxacin** and **taraxacein.**

ACTION

Taraxacum acts as a simple bitter and laxative. It also increases the flow of urine.

Preparations

Extract of Taraxacum (Extractum Taraxaci)	0.3–1.0 gm.	grs. v–xv
Fluidextract of Taraxacum (Fluidextractum Taraxaci)	4.0–8.0 c.c.	ʒi–ii

JUNIPER

Juniper is obtained from the unripe, full sized berries of the **Juniper communis,** or juniper plant. Its active principle is a volatile oil, the oil of juniper, which is obtained by distilling the berries.

ACTION

Local action: Juniper produces slight redness of the skin and mucous membranes if applied locally.

Internal Action

Taken internally: It increases the secretion of the stomach and intestines. It thereby increases the appetite and aids digestion. Its principal effect, however, is to increase the flow of urine.

Poisonous Effects

Overdoses of juniper usually cause painful urination with bloody urine.

Administration

Juniper is rarely given alone. It is usually combined with cream of tartar or other alkaline diuretics.

Preparations

Oil of Juniper (Oleum Juniperi)	0.3–1.0 c.c.	m. v–xv
Spirits of Juniper (Spiritus Juniperi)	2.0–4.0 c.c.	m. xxx–ʒi

The most commonly used preparation, however, is the infusion of juniper berries. It is made by boiling an ounce of the berries in a pint of water, and is given in doses of 2.0 to 4.0 c.c. (ʒi–ii).

TURPENTINE (TEREBINTHINA)

There are two kinds of turpentines: **turpentine** or **white turpentine,** and **Canada turpentine** or **Canada balsam.**

Turpentine, or white turpentine, terebinthina, is a thick resinous substance, or solid oleoresin obtained from the sap of the **Pinus palustris,** and other species of pine trees.

Canada turpentine, **terebenthina canadensis,** or Canada balsam, or balsam of fir, is a liquid oleoresin obtained from the **Abies balsamea,** the American silver fir, or balm of gilead tree, which grows in the northern parts of the United States. This form of turpentine is seldom used. The turpentines contain a volatile oil, oil of turpentine, or spirit of turpentine, which causes their effects.

ACTION

Local action: Turpentine or the spirit of turpentine, reddens the skin. If it is kept on the skin for any length of time, it causes blisters.

Internal Action

When taken internally, the oil of turpentine produces the following effects.

In the stomach: It checks the formation, and hastens the

expulsion of gas. Part of it is absorbed into the blood from the stomach.

In the intestines: It acts as an antiseptic, checking the growth of bacteria. It expels gas and increases peristalsis. It is said to expel worms.

On the kidneys: Turpentine and the oil of turpentine increases the flow of urine. This effect is produced by the turpentine after it is absorbed into the blood.

Turpentine is said to make the pulse somewhat stronger and faster.

Excretion

Turpentine is eliminated from the body by the lungs, where it increases the cough and expectoration, and acts as an antiseptic. It is also excreted by the kidneys and gives the urine a violet color.

Poisonous Effects

Overdoses of turpentine cause:

1. Unconsciousness.
2. Scanty, often bloody urine.
3. Rapid, feeble pulse.
4. Occasionally vomiting, and diarrhoea, with painful stools.

Uses

Turpentine is applied to the skin to relieve pain and to withdraw blood from the deeper tissues; occasionally to form a blister.

To increase the flow of urine.

To expel gas from the intestines.

To increase the cough and expectoration, and to check the growth of bacteria in the lungs.

Administration

For its effects on the skin, turpentine liniments are used, or it is applied in the form of a "stupe."

Turpentine Stupe

A turpentine stupe is applied by dipping a piece of flannel

in hot water, to which a few drops of hot turpentine oil have been added. The flannel is wrung out, and applied over the skin, which should be covered with vaseline to prevent the formation of blisters.

Internally, turpentine is best given in capsules or in an emulsion. As an expectorant, it is frequently given by inhalations.

Turpentine is also often added to enemas to help the intestines to expel gas.

Preparations

Oil of Turpentine (Oleum Terebinthinae)	0.3–1.0 c.c.	m. v–xv

This is obtained by distilling turpentine.

Purified Oil of Turpentine (Oleum Terebinthinae Rectificatum)	0.3–1.0 c.c.	m. v–xv
Emulsion of Turpentine Oil (Emulsum Olei Terebinthinæ)	4.0 c.c.	ʒi
Turpentine Liniment (Linimentum Terebinthinae)		

UVA URSI (BEAR BERRY)

Uva ursi is obtained from the leaves of the **Arctostaphylos uva ursi,** an evergreen shrub growing in northern Europe and the United States. Its active principles are the glucosides, **arbutin** and **methylarbutin.** It also contains an inactive glucoside ericolin, and small quantities of tannic and gallic acids.

ACTION

Because of the tannic and gallic acids which it contains, uva ursi contracts mucous membranes.

The principal action of uva ursi, however, is to increase the flow of urine, by directly increasing the activity of the kidney cells. This effect is due to the arbutin which it contains. It also acts as an antiseptic on the mucous membranes of the ureter, bladder and urethra.

Preparations

Fluidextract of Uva Ursi (Fluidextractum Uvae Ursi)	1.0–4.0 c.c.	m. v–xv

CHIMAPHILA (PIPSISSEWA)

Chimaphila is obtained from the leaves of **Chimaphila umbellata,** an American plant. Its active principles are the glucosides **arbutin,** and **chimaphilin,** another crystalline substance. It also contains some tannic and gallic acids.

ACTION

Chimaphila produces the same effects as uva ursi. It contracts the mucous membranes and increases the flow of urine.

Preparations

Fluidextract of Chimaphila (Fluidextractum Chimaphilae)	2.0–4.0 c.c.	ʒ½–i

ZEA (CORNSILK)

Zea is obtained from the silky threads of the **Zea mays** or Indian corn or maize.

ACTION

Zea increases the flow of urine and acts as an antiseptic on the mucous membranes of the ureter, bladder and urethra.

Preparations

Fluidextract of Zea (Fluidextractum Zeae)	4.0–8.0 c.c.	ʒi–ii

TRITICUM

Triticum is obtained from the **Agropyron repens,** or couch grass, a grass which grows in Europe and the United States.

ACTION

Triticum is said to increase the flow of urine. It is usually given in the form of a decoction about 8.0–16.0 c.c. (ʒii–iv) in a large tumbler full of water.

Preparations

Fluidextract of Triticum (Fluidextractum Tritici)	2.0–4.0 c.c.	ʒ½–i

ASPARAGIN (not official)

This is a substance which is contained in **asparagus and marshmallow root.** It increases the flow of urine, and is given in doses of 0.03–0.06 gm. (gr. ½–i).

CORONILLIN

This is the active glucoside of **Coronilla scorproides.** It is used to increase the flow of urine and to strengthen the heart action. It is given in doses of 0.06–0.3 gm. (grs. i–v).

SALINE DIURETICS

The following mineral salts are frequently used to increase the flow of urine. Most of them are salts of the alkalis and are used to produce other effects.

ACTION

The salts belonging to this group affect principally the stomach, intestines and the kidneys.

Action in the stomach: Because of their alkaline reaction, these salts neutralize the acid in the stomach.

Action in the intestines: Most of these salts act as cathartics. They produce frequent fluid movements of the bowels. For this effect they must be given in somewhat larger doses than usual.

Action on the kidneys: The effect of these salts on the kidney is to increase the flow of urine. This effect results after they are absorbed, and are not produced by those salts which are not readily absorbed.

Preparations

Salts of Potassium

Potassium Acetate (Potassii Acetas)	0.6–4.0 gms.	grs. x–ʒi

This is a salt of potassium and acetic acid.

Potassium Bitartarate 0.6–4.0 gms. grs. x–ʒi
(Potassii Bitartaras)
(Cream of Tartar.)

This is a salt of potassium and tartaric acid. It is usually given in hot water, flavored with lemon juice. It is rarely given alone, usually together with the infusion of juniper.

Potassium Citrate 0.6–1.2 gm. grs. x–xx
(Potassii Citras)

This is not as unpleasant to take as the other potassium salts. It increases the secretion of sweat (diaphoretic action), as well as the secretion of urine.

Solution of Potassium Citrate 15.0–30.0 c.c. ʒ½–i
(Liquor Potassii Citratis)

This contains about 8% of potassium bicarbonate, and about 6% of citric acid.

Effervescent Potassium Citrate 2.0–4.0 c.c. ʒ½–i
(Potassii Citras Effervescens)

This consists of potassium citrate 20%, potassium bicarbonate and sugar.

Effervescent Draught
(Not official)

This is made by adding 30.0 gms. (ʒi) of potassium bicarbonate to 30.0 gms. (ʒi) of lemon juice.

Other potassium salts which are occasionally used as diuretics, are potassium bicarbonate, potassium carbonate, potassium chlorate and potassium sulphate.

Salts of Sodium

The only salt of sodium that is used to increase the flow of urine, is sodium acetate.

Sodium Acetate 0.6–4.0 gms. grs. x–ʒi
(Sodii Acetas)

Salts of Lithium

The salts of lithium produce the same effects as the potassium salts.

Their principal effect is to increase the flow of urine.

They are said to dissolve crystals in the urine and to prevent the formation of stones in the kidney in this way.

Preparations

Lithium Benzoate (Lithii Benzoas)	0.3–1.0 gm.	grs. v–xv
Lithium Carbonate (Lithii Carbonas)	0.3–1.0 gm.	grs. v–xv
Lithium Citrate (Lithii Citras)	0.3–1.0 gm.	grs. v–xv
Effervescent Lithium Citrate (Lithii Citras Effervescens)	4.0–8.0 gms.	ʒi–ii

This contains citric acid, lithium carbonate, sodium bicarbonate and sugar.

Salts of Strontium

Strontium lactate is the only salt of strontium which increases the flow of urine.

Strontium Lactate (Strontii Lactas)	0.3–1.0 gm.	grs. v–xv

THE NITRATES

The nitrates are salts formed by the combination of nitric acid and an alkali.

ACTION

The nitrates are very cooling, and increase the flow of urine; and occasionally the secretion of sweat.

Poisonous Effects

Overdoses of the nitrates often cause the following symptoms.

1. Burning pain in the throat, and in the abdomen.
2. Nausea and vomiting; the vomited matter often contains blood.
3. Diarrhoea, with bloody stools.
4. Profuse secretion of urine, or scanty urine.
5. Great muscular weakness.
6. Collapse, coma and death.

Preparations

Potassium Nitrate (Potassii Nitras) (Saltpeter)	0.3–2.0 gms.	grs. v–xxx

This preparation is the one which is commonly used. It is found in salt beds and caves in India and the United States.

Sodium Nitrate (Sodii Nitras)	0.3–2.0 gms.	grs. v–xxx

PIPERAZINE

Piperazine is a substance formed by the combination of ammonia and ethylene bromide.

ACTION

It increases the flow of urine and is said to dissolve the crystals which form stones in the kidney. It is frequently used as a remedy in gout.

Preparations

Piperazine (Piperazinum)	0.3–0.6 gm.	grs. v–x

MERCURY SALTS

The following salts of mercury are often used to increase the flow of urine.

Calomel (Hydrargyri Chloridi Mite)	0.015–0.15 gm.	grs. ½–ii

As a diuretic, calomel is often given in the form of Guy's or Fothergill's pill.

This contains:

Calomel
Powdered squills.
Powdered digitalis of each 0.06 gm. gr. i

Bichloride of mercury, in small doses also increases the flow of urine. In poisonous doses, it causes severe destruction of the kidney cells with lessened secretion of urine. Uraemia and death result from this condition.

SPIRIT OF NITROUS ETHER

This preparation increases the flow of urine, if the skin surface is kept cool. It produces other important effects however, under which it will be considered.

Spirits of Nitrous Ether or Sweet Spirit of Niter (Spiritus Aetheris Nitrosi)	4.0–16.0 c.c.	ʒi–iv

URINARY ANTISEPTICS ACTING AS DIURETICS

The following drugs act as antiseptics in the kidney, bladder and urethra. They also increase the flow of urine.

Urotropin
Methylene Blue
Buchu
Oil of Erigeron
Oil of Santal
Copaiba
Cubebs
Matico

The following drugs are principally used locally but they also increase the flow of urine.

Cantharides
Turpentine Oil

PART III—DEPRESSANTS

CHAPTER XV

CARDIAC AND VASCULAR DEPRESSANTS

The most important effect of the following group of drugs is to lessen the action of the heart. (See page 152 for heart depression.)

ACONITE (MONK'S HOOD OR WOLFSBANE)

Aconite is obtained from the root of **Aconitum napellus,** monk's hood or wolfsbane, a perennial plant growing in the mountainous regions of Europe and Asia. The root often resembles horse-radish in appearance. The active principle of aconite, is the alkaloid **aconitine.** There are other species of aconite which contain several similar alkaloids such as pseudaconitine and japaconitine, which produce the same effects as aconitine.

Appearance of the Patient

When an average dose of aconite is given, the patient's mouth and throat feel warm, and he often complains of slight numbness and tingling of the lips, tongue and throat, or even in the extremities. The pulse is slower and somewhat weaker, and the breathing is usually slow and shallow. The temperature is lowered and the patient often feels quite weak.

ACTION

Local action: Applied to the skin or mucous membranes, aconite or aconitine causes a prickling or tingling sensation. This is due to the greater sensitiveness of the nerve endings in the skin or mucous membranes. The ordinary sensations of touch are then felt as prickling or tingling sensations.

Soon however, these nerve endings are paralyzed, and the skin or mucous membranes feel numb. Very often this increased sensitiveness causes various reflex actions. For example—when aconite is applied to the mucous membrane of the nose, it causes sneezing. Increased flow of saliva, vomiting and coughing also often result from the local application of aconite to mucous membranes.

Internal Action

In the mouth: Aconite has a bitter taste and causes a prickling and tingling sensation followed by numbness in the mouth and throat. This effect on the nerve endings in the mouth, causes a reflex flow of saliva.

In the stomach and intestines: In the doses that aconite is usually given, it produces no effect. In larger doses, however, it often causes nausea and vomiting by the reflex contractions of the muscles of the stomach and intestines, as a result of the greater sensitiveness of their nerve endings.

Action after Absorption

Aconite is absorbed into the blood stream through the lining membrane of the stomach, usually in about half an hour after it is given. After absorption, it acts principally upon the heart, the respiration, the nerve endings and the temperature.

Action on the heart: Aconite makes the heart beat slower and weaker, and lessens the blood pressure. The effect on the heart is due to the greater number of impulses which are sent to the heart from the cardio-inhibitory center in the medulla of the brain, along the Vagus or inhibitory nerves.

The pulse of aconite is usually slow, weak, soft and compressible.

Action on the respiration: Aconite makes the breathing slower but somewhat deeper and more difficult. The slow breathing is due to the fewer impulses for breathing which are sent from the respiratory center in the medulla.

Action on the nervous system: Aconite does not act on the brain, but it produces important effects as a result of its action on the nerve endings.

Action on the nerve endings: Aconite, either when taken internally, or when applied locally, makes the sensory nerve endings of the skin and mucous membranes more sensitive at first, and later paralyzes them. This produces the tingling and prickling sensations, followed by numbness, which are so characteristic of aconite.

The muscular weakness produced by aconite in large doses, is due to its effect on the nerve endings in the muscles.

Action on the secretory glands: Aconite increases the secretion of sweat and saliva, and it is said to increase the flow of urine.

Effect on temperature: It reduces temperature by increasing the elimination of heat.

Excretion

Aconite is eliminated from the body in about three or four hours after it is given, mainly by the urine.

Poisonous Effects

Since aconite is rapidly excreted, only acute aconite poisoning occurs, usually from the administration of an overdose.

Aconite is one of the few poisons which causes death very rapidly. If a sufficiently large dose is taken, the patient may die immediately, from sudden paralysis of the heart. Usually, however, the symptoms appear very rapidly and the patient dies in about three or four hours.

Symptoms

The first, and diagnostic symptom of aconite poisoning is:

1. **The characteristic tingling and prickling sensation on the lips, mouth and throat,** and a smarting tingling feeling of the skin of the extremities, **soon followed by numbness.**

Associated with these symptoms are:

2. Profuse flow of saliva.
3. Nausea and vomiting.
4. Great muscular weakness.

5. Slow, irregular, weak pulse.

6. Slow, shallow, difficult, irregular breathing.

7. Collapse (cold, moist skin; anxious face; protruding eyeballs with dilated pupils; rapid, thready, very weak pulse).

8. Often there are convulsions and unconsciousness just before death. Usually however, consciousness remains to the last. Death usually results from paralysis of the respiration.

Treatment

To save a patient from aconite poisoning, quick action is necessary, as death results very rapidly.

1. Wash out the stomach.

2. **Give atropine as an antidote.**

This prevents the slow weak heart action, by paralyzing the nerve endings in the heart, of the Vagus nerve, and it also makes the breathing faster and deeper.

3. Keep the patient absolutely quiet, flat on his back, and lower the head by removing the pillows, and elevate the foot of the bed. Keep the patient warm.

4. Give artificial respiration.

5. Give heart stimulants such as caffeine, whiskey, ammonia, etc.

Uses

Aconite is now rarely used. It is principally given to reduce fever in acute infectious diseases.

Preparations

Fluidextract of Aconite (Fluidextractum Aconiti)	0.06–0.12 c.c.	m. i–ii
Tincture of Aconite (Tinctura Aconiti)	0.06–0.3 c.c.	m. i–v

This is the preparation commonly used.

For Local Use

Aconite Liniment (not official)
(Linimentum Aconiti)

This contains about 2% of aconite, and is an ingredient

of many patent medicines which are used to relieve the pains of chronic rheumatism.

Aconite Ointment (not official)
(Unguentum Aconiti)

This contains 2% of aconite.

Aconitine

Aconitine (Aconitina)	0.00015–0.0006 gm.	gr. $\frac{1}{400}$ – $\frac{1}{100}$

STAPHISAGRIA (STAVESACRE OR DELPHINIUM)

Staphisagria or stavesacre is obtained from the dried ripe seeds of **Delphinium staphisagria** or stavesacre.

Its active principle is an alkaloid **delphinine,** which produces the same effects as Aconitine.

Delphinine is used in the form of a tincture or ointment to destroy parasites such as lice.

VERATRUM (AMERICAN HELLEBORE)

Veratrum is obtained from the root and underground stems of the **Veratrum viride**, or green hellebore, a plant which grows in swampy places in the northern part of the United States. It is commonly known as American or swamp hellebore, or Indian poke. There is also another species of veratrum known as **Veratrum album,** or white hellebore.

The active principles of veratrum, are the alkaloids **veratrine** and **protoveratrine.** These alkaloids are very closely related to aconitine chemically, and they produce very similar effects.

ACTION

Local action: Applied to the skin, or mucous membranes, as in the form of an ointment, veratrum causes a tingling and prickling sensation, soon followed by numbness. This is due to the sensory nerve endings being made more sensitive and then paralyzed. In the nose, for example, the application of veratrum causes sneezing, as a result of the increased sensitiveness of the nerve endings.

Internal Action

In the mouth: Veratrum has a bitter taste, and by its effect on the nerve endings in the mouth, it causes a reflex flow of saliva.

In the stomach: Veratrum often causes nausea and vomiting, by making the nerve endings in the stomach more sensitive, thereby increasing the reflex impulses for vomiting.

In the intestines: It causes frequent movements of the bowels, probably by the reflex contractions of the intestinal muscles, as a result of the increased sensitiveness of the nerve endings in the mucous membrane.

Action after Absorption

Veratrum is rapidly absorbed from the stomach. After absorption it affects principally the heart, the respiration, the muscles and nerve endings.

Action on the heart: Veratrum makes the heart beat slower and weaker, by increasing the impulses which slow the heart, that are sent out from the Vagus or inhibitory center in the medulla of the brain along the Vagus nerves. It also prolongs the period of relaxation which follows each period of contraction of the heart muscle.

The pulse of veratrum is therefore slower, weaker, softer and more compressible.

Action on the respiration: Veratrum makes the breathing slower, shallower and more difficult.

Action on the muscles: It produces a peculiar and characteristic effect on voluntary muscles. It lengthens the period of relaxation which follows each contraction.

Action on nerve endings: Veratrum produces the same tingling and numbness of the skin as aconite does, by first making the sensory nerve endings more sensitive, and then paralyzing them.

The vomiting and diarrhoea often produced by veratrum are due to this action.

Action on the secretory glands: It often causes an increased secretion of saliva and sweat.

Effect on the temperature: Veratrum lowers the temperature by increasing the elimination of heat.

Excretion

Veratrum is rapidly excreted, mainly by the urine.

Poisonous Effects

Poisoning from veratrum rarely occurs, since it causes such violent vomiting, that the drug is soon excreted in the vomited matter, and it is therefore rarely fatal. Occasionally, the following alarming symptoms occur:

1. Tingling and numbness of the mouth, lips, and skin of the extremities.
2. Profuse diarrhoea.
3. Slow, weak, irregular pulse.
4. Slow and shallow breathing.
5. Occasionally dizziness.
6. Restlessness.
7. Muscular twitchings.
8. Convulsions.
9. Collapse

The treatment is the same as for aconite poisoning.

Uses

Veratrum is occasionally used as a substitute for aconite.

Preparations

Fluidextract of Veratrum (Fluidextractum Veratri)	0.06–0.3 c.c.	m. i–v
Tincture of Veratrum (Tinctura Veratri)	0.3–1.0 c.c.	m. v–xv

VERATRINE

Veratrine is a mixture of all the alkaloids found in **Veratrum sabadilla**, or **Asagraea officinalis**, a Mexican plant known as cevadilla. The most important of these alkaloids are **veratrine** and **protoveratrine**, which are also found in veratrum viride.

ACTION

Veratrine produces the same effects as the veratrum viride, or its alkaloid veratrine, with the following slight differences.

1. Veratrine is more poisonous and causes convulsions, and death from asphyxia.
2. When locally applied, in addition to the tingling and numbness, it often causes blisters.

Uses

Veratrine is used principally to relieve pain in neuralgia, rheumatism, etc.

Preparations

Veratrine Ointment
(Unguentum Veratrinae)

This contains 4% of veratrine.

Oleate of Veratrine
(Oleatum Veratrinae)

This contains 2% of veratrine.

ARNICA

Arnica is obtained from the flowers of the **Arnica montana,** or leopard's bane, a plant growing in northern Europe, Asia and the northwestern part of the United States. Its active principles are **arnicin,** an alkaloid, a volatile oil and several resinous substances.

ACTION

Local action: Applied to the skin, it causes redness and improves the circulation. It is said to cause the absorption of blood which has gathered in the tissues, after an injury or bruise (haematoma).

Internal Action

When arnica is taken internally, it makes the heart beat slower. It is also said to increase the secretion of sweat, and the flow of urine. It is excreted mainly by the urine.

Poisonous Effects

Arnica should never be applied to an open wound, as it often produces poisonous symptoms from such applications.

Symptoms

1. Nausea, vomiting and diarrhoea.
2. Collapse (rapid, thready pulse, cold skin, shallow breathing, etc.).

Preparations

Tincture of Arnica (Tinctura Arnicae)	0.3–2.0 c.c.	m. v–xxx

This preparation is rarely used internally in this country. It is principally used locally on sprains, bruises, etc. It should be diluted and then applied on a piece of flannel, which is then covered with a bandage.

Other Cardiac Sedatives

The following drugs also lessen the heart action, but they have other more important effects under which they will be described.

They cause slow, weak contractions of the heart, producing a slow, weak pulse.

Eserine or Physostigmine
Pilocarpine
Grindelia
Lobelia
Dilute Hydrocyanic Acid

VASO-DILATORS

The following drugs act principally on the blood-vessels. They lessen the contractions of the small muscle fibers in their walls, so that the blood vessels are then widened. As a result of this action, various effects are produced upon various organs and tissues of the body.

THE NITRITES

The nitrites are salts formed by the combination of nitrous acid with an alkali, or an organic substance such as an alcohol, as amylic alcohol. The most important compounds formed in this way, are **amyl nitrite** and **nitroglycerine.** The former of these substances produces rapid effects which soon pass off, while the latter drug produces slower effects which are more lasting.

AMYL NITRITE

Amyl nitrite is a yellow fluid which evaporates easily, and has a characteristic odor of fruit. It is made by distilling nitric acid with amylic alcohol, sulphuric acid and copper, and then purifying the resulting liquid.

Appearance of the Patient

About three to five minutes after an average dose of amyl nitrite is inhaled, the face becomes flushed, and sometimes the skin all over the body as well. The patient complains of fullness and throbbing in the head, and often of severe headache. The pulse is rapid, soft and bounding, and the breathing is rapid and somewhat deeper. These symptoms last for about ten to fifteen minutes, and then pass off.

ACTION

Amyl nitrite causes **no local effects,** and since it is usually given by inhalation, it produces **no effects in the stomach and intestines.**

Action after Absorption

Amyl nitrite is inhaled into the lungs. There, it is absorbed into the blood through the lining membrane of the lungs, usually in about five minutes. After absorption, it affects principally the blood vessels, the heart, the respiration and the blood.

Action on the circulation: Amyl nitrite does not affect the heart directly, but by means of its action on the blood vessels.

Action on the blood vessels: Amyl nitrite affects principally the blood vessels. It paralyzes the small involuntary muscle fibers in the walls of the small blood vessels. As a result of this action, these blood vessels are widened, so that it is easier for the blood to pass through them, and the blood pressure is lessened. The heart does not then have to contract so forcibly, because the blood moves along more freely, and it does not need much propelling force, since the blood vessels are wider. The heart contracts faster, however, because the wider blood vessels offer very little resistance to the contractions of the heart, which then contracts with greater ease. By this action on the blood vessels, amyl nitrite eases the action of the heart, and relieves it, when it is overworking because of increased blood pressure, or spasmodic contractions of the blood vessels.

The blood vessels of the abdomen and head are more affected than those of the extremities. The widened blood vessels of the face and head, cause the flushed face, the fullness and throbbing in the head, which are so characteristic of amyl nitrite action.

The total effect of amyl nitrite on the circulation is to **make the heart beat faster, and to lower the blood pressure.** Its characteristic **pulse is rapid, soft and bounding, with low blood pressure.** The bounding quality of the pulse is quite characteristic of amyl nitrite, and is due to the widened blood vessels, which allow the contractions of the heart to be more easily transmitted.

Action on the respiration: Amyl nitrite makes the breathing faster and deeper.

Action on the nervous system: Amyl nitrite does not affect the brain directly. The headache, fullness and throbbing sensation in the head, and the slight confusion so characteristic of amyl nitrite are due to the widened blood vessels in the brain; which then contains more blood (congestion).

Effect on sight: In some people, the sense of sight is peculiarly affected by amyl nitrite. Dark objects seem to be surrounded by a yellow ring, and this again by a blue one.

Effect on temperature: The temperature is lowered by amyl nitrite, because of the widened blood vessels in the skin, which increases the elimination of heat.

Action on the kidneys: It increases the flow of urine by dilating the blood vessels of the kidneys; which then contain more blood, and are therefore able to secrete more urine. The urine sometimes contains sugar.

Excretion

Amyl nitrite is very rapidly eliminated from the body, usually within a half hour; mainly by the kidneys. It is excreted in the urine as various salts, such as nitrites and nitrates.

Poisonous Effects

Overdoses of amyl nitrite usually cause the following symptoms:

1. Slow, weak and irregular pulse.
2. Slow and shallow breathing.
3. The blood has a dark chocolate color, due to the formation of methaemoglobin, which prevents the haemoglobin from combining with oxygen.
4. Intense headache.
5. Dizziness.
6. Dilated pupils.
7. Occasionally convulsions occur.
8. Collapse (slow, very weak pulse, slow and shallow breathing, cold, moist skin, etc.).

Treatment

Amyl nitrite is rarely fatal, the poisonous symptoms usually disappear when the drug is stopped.

1. Give artificial respiration.
2. Give heart stimulants such as caffeine, strychnine, etc.

Administration

Amyl nitrite is usually given by inhalation. It comes in small glass "pearls," each containing about 0.2–0.3 c.c. (m. iii–v) of amyl nitrite, which are broken in a handkerchief and then applied to the nose of the patient. The handkerchief should be withdrawn as soon as the effects are produced. Amyl nitrite is occasionally given hypodermically. It is also given by the mouth; about 0.2–0.3 c.c. (m. iii–v) dropped on a piece of sugar; but the effects then appear very slowly.

Uses

Amyl nitrite is used:

1. To relieve an attack of "angina pectoris," a disease characterized by attacks of severe pain around the heart, and shooting pains into the arms. This disease is due to the spasmodic contractions of the muscle wall of the coronary arteries in the heart. (These vessels supply the heart muscle with blood.) Amyl nitrite relieves these attacks by relaxing the spasms of these blood vessels.
2. To relieve an attack of bronchial asthma; by relaxing the spasm of the involuntary muscles in the walls of the bronchi.

Preparations

Amyl Nitrite (Amylis Nitris)	0.15–0.3 c.c.	m. ii–v

This comes in small glass capsules (pearls) each containing the required dose. It should always be fresh; as it decomposes very easily.

NITROGLYCERIN AND OTHER NITRITES

Nitroglycerin or spirits of glonoin, is a colorless, oily liquid which has an odor and taste like alcohol. Nitroglycerin combined with porous silica forms dynamite. Preparations of nitroglycerin should be very carefully handled,

as it is apt to explode when dropped on the floor, when heated, or when rubbed vigorously. If it is accidentally spilled, it should be destroyed immediately, by pouring potassium hydroxide solution over it.

A 1% alcoholic solution is used as a medicine, which should always be kept cool, as it may explode when exposed to heat.

Appearance of the Patient

About five minutes after taking an average dose of nitroglycerin, the patient complains of a feeling of fullness in the head, with frontal headache, and occasionally dizziness. The face is flushed, the pulse is rapid, soft and bounding, and the blood pressure is diminished. The breathing is faster and deeper. These effects last about three-quarters to one hour, and then wear off. The headache may remain for several hours, however.

ACTION

The effects of nitroglycerin are similar to those of amyl nitrite, but they are more lasting.

Local action: Nitroglycerin may redden the skin or mucous membranes if applied locally.

Internal Action

In the mouth: Nitroglycerin has a pungent taste.

In the stomach: It causes a sense of warmth. Since it is rapidly absorbed from the stomach, it produces no effects in the intestines.

Action after Absorption

Nitroglycerin is very rapidly absorbed into the blood, through the lining membrane of the stomach, usually in about five to ten minutes. After absorption, it affects principally the blood vessels, the respiration and the kidneys.

Action on the blood vessels: Nitroglycerin widens the blood vessels, by paralyzing the muscle fibers in their walls. This lessens the blood pressure, and eases the work of the heart; which then beats faster. **The pulse after nitroglycerin**

is rapid, soft and bounding and the blood pressure is low. It is often dicrotic.

Action on the respiration: It makes the breathing faster and deeper.

Action on the nervous system: Nitroglycerin does not affect the nervous system directly. The headache, the fullness in the head and the occasional dizziness, are due to the dilated blood vessels in the brain, which then contains more blood (congestion), and gives rise to these sensations.

Effect on temperature: The temperature is somewhat lowered.

Action on the kidneys: The flow of urine is often increased by nitroglycerin, when the kidneys do not secrete a sufficient amount of urine, because of the lessened blood pressure. The better circulation of blood in the kidneys as a result of the widened blood vessels, increases the secretion of urine.

Excretion

Nitroglycerin is excreted by the urine, usually in about one or two hours.

Poisonous Effects

Poisoning from nitroglycerin, usually occurs in two forms, acute poisoning, and chronic poisoning or cumulative symptoms.

Acute Poisoning

This usually results from a single overdose of nitroglycerin.

Symptoms

1. Slow, weak, irregular pulse.
2. Slow and shallow breathing.
3. Intense headache.
4. Dizziness.
5. Dilated pupils.
6. Occasionally convulsions.
7. Collapse.

These symptoms have resulted from as little as two to ten drops of nitroglycerin.

Treatment

1. Give heart stimulants, such as caffeine, strychnine, digalen, etc.
2. Give artificial respiration if necessary.

Chronic Poisoning or Cumulative Symptoms

Since nitroglycerin is often given in repeated doses for a long time, poisonous symptoms may come on gradually, which indicate that the patient is getting too much of the drug, and it should then be stopped.

Symptoms

(In the order of their onset)

1. Intense headache.
2. Feeling of a tight band around the head.
3. Dizziness.
4. Constriction of the throat.
5. Nausea and feeling of weakness in the region of the stomach.
6. Slow, irregular pulse.
7. Slow, shallow, breathing.

When the drug is stopped, these symptoms usually disappear.

Uses

Nitroglycerin is given principally in repeated doses for a long time, in the following conditions.

1. **Arteriosclerosis** or hardening of the arteries.

It relaxes the contractions of the arteries whose muscle fibers have not yet been replaced by connective tissue. In many cases nitroglycerin produces no effect, as the muscle fibers have been replaced by fibrous tissue, which cannot relax.

2. To reduce blood pressure, in nephritis.
3. To relax the contractions of the involuntary muscles in the bronchi, in asthma.
4. To prevent the attacks of angina pectoris by keeping the muscles of the coronary blood vessels of the heart relaxed.

Administration

Nitroglycerin is given either in a 1% alcoholic solution, or in tablets; best after meals. It is suitable in conditions where continual effects from the nitrites are desired. Since this effect lasts for only an hour, it should be repeated frequently; about every hour.

Preparations

Spirits of Glyceryl Trinitrate (Spiritus Glycerylis Nitratis) **Nitroglycerin or Spirits of Glonoin** 0.03–0.2 c.c. m. ½–iii

This is a 1% alcoholic solution of nitroglycerin. It should always be fresh; as it decomposes very easily.

Tablets of Nitroglycerin (Tabellae Trinitri) 0.0006 gm. gr. $\frac{1}{100}$

(Not official)

1 to 2 tablets are given at a time.

These are not as efficient as a solution of the drug, and they decompose very easily.

SWEET SPIRITS OF NITER (SPIRITUS AETHERIS NITROSI)

Sweet spirit of niter is a 4% solution of nitrous ether, or ethyl nitrite, in alcohol. It evaporates very easily and is inflammable. It should always be fresh; as old solutions decompose.

ACTION

Sweet spirit of niter produces the same effects as nitroglycerin or the other nitrites.

It dilates the blood vessels by paralyzing their muscle fibers, and causes:

1. A rapid, soft, bounding pulse.
2. Rapid breathing.
3. Increased flow of urine, by relaxing the blood vessels of the kidneys.
4. Increased secretion of sweat, by widening the blood

vessels of the skin, so that the sweat glands are supplied with more blood from which to secrete perspiration.

Poisonous Effects

Inhalation of sweet spirit of niter has produced dangerous, even fatal symptoms; resembling those produced by amyl nitrite.

Symptoms

1. Headache.
2. Pain around the heart.
3. Weak, slow pulse.
4. Slow, shallow breathing.
5. Muscular weakness.
6. Collapse.

Uses

Sweet spirit of niter is used to increase the sweat and thereby to reduce fever, especially in children. It is given in small doses, well diluted; and the patient should be kept in bed, warmly covered. If the skin is kept cool, it increases the flow of urine.

Preparations

Spirits of Nitrous Ether (Spiritus Aetheris Nitrosi) Sweet Spirit of Niter	1.0–4.0 c.c.	3¼–i

SODIUM AND POTASSIUM NITRITES

Sodium and potassium nitrites are salts formed by the combination of sodium or potassium, with nitrous acid.

They produce the same effects as amyl nitrite or nitroglycerin, with the following variations.

1. Their effects appear very slowly, usually in about a half hour, but they last for several hours.
2. They often cause nausea, belching of gas, and pain in the stomach, and occasionally diarrhoea.
3. They do not cause as much headache, or flushing of the face as amyl nitrite or nitroglycerin does.

Uses

The nitrite of either sodium or potassium, is suitable for continued use, to lower the blood pressure.

Preparations

Sodium Nitrite (Sodii Nitras)	0.06–0.12 gm.	grs. i–ii

This is given in solution or in tablets.

Potassium Nitrite (Potassii Nitras)	0.06–0.12 gm.	grs. i–ii

This is not official and is rarely used.

New and Non-official Preparations of the Nitrites

Erythrol Tetranitrate (Tetranitrol)	0.03–0.06 gm.	gr. ½–i
Mannitol Hexanitrate	0.03–0.06 gm.	gr. ½–i

These preparations are given in tablets, because they are explosive in fluid form.

ACTION

These preparations produce the same effects as nitroglycerin, but they are more lasting. The effects usually appear in about 15 minutes and last for about 3 or 4 hours.

CHAPTER XVI

RESPIRATORY DEPRESSANTS

The following drugs make the breathing slower and shallower. They have already been described, or they will be described later, under their more important effects.

Opium
Morphine
Codeine
Bromides
Chloral
Trional
Tetronal
Veronal
Sulphonal
Paraldehyde
Amylene hydrate and other similar hypnotics

The following drugs are used principally to check excessive coughing and make the breathing slower and shallower.

DILUTE HYDROCYANIC ACID (DILUTE PRUSSIC ACID)

Dilute hydrocyanic acid, or acidum hydrocyanicum dilutum, is a 2% solution of pure hydrocyanic or prussic acid. It is formed by the combination of hydrochloric acid and silver cyanide. It is a colorless inflammable fluid which evaporates very easily. Hydrocyanic acid is the most poisonous substance known. The inhalation of its fumes, causes instant death. Scheele, the chemist who discovered it, is said to have died from inhaling its fumes.

Bitter almonds, and the kernels of the seeds of various fruits such as peaches, cherries, apricots, plums and prunes, contain a glucoside **amygdalin** and a ferment **emulsin.** When these kernels are rubbed in water, the emulsin changes

the amygdalin into **prussic acid**, glucose (a sugar) and another substance. The syrup of wild cherry bark (**Syrupus pruni virginianae**) also contains very small quantities of hydrocyanic acid.

ACTION

Hydrocyanic acid is rarely used except as an ingredient of cough mixtures, to lessen coughing.

Local action: Hydrocyanic acid causes numbness of the skin or mucous membranes, if applied locally to them, by paralyzing their sensory nerve endings. It is often absorbed from the injured skin, and may then cause poisonous symptoms.

Internal Action

When taken internally, it has a bitter taste, it increases the flow of saliva, and causes a sense of warmth in the stomach and intestines. It is readily absorbed from the stomach in about 15 to 20 minutes and it then produces the following effects.

Action on the respiration: It makes the breathing slower and shallower by lessening the impulses for breathing, which are sent out from the respiratory center in the medulla. In this way, it lessens coughing.

Action on the heart: It makes the heart beat slower, by sending more impulses to the heart from the Vagus or inhibitory center of the medulla. It also weakens the contractions of the heart muscle.

Action on the blood vessels: It contracts the blood vessels, thereby increasing the blood pressure for a very short time. The blood vessels soon dilate, however, and the blood pressure is lessened.

The characteristic pulse of hydrocyanic acid, then, is slow, at first strong, but it soon becomes weak.

It has a very important effect on **nutrition.**

Action on nutrition: It prevents the tissues from combining with oxygen, and thereby obtaining nourishment. It is for this reason, that the blood in the veins has a bright red color like that of the blood in the arteries. The tissues have not been able to take away the oxygen from the haemo-

globin of the arterial blood, and the blood in the veins contains the haemoglobin still combined with the oxygen.

Excretion

Hydrocyanic acid is rapidly eliminated by the kidney, combined with sulphur, as sulphocyanides, and also by the lungs.

Poisonous Effects

Hydrocyanic acid is the most poisonous substance known. When it is administered, the patient should be watched carefully for symptoms of excessive action.

Excessive Effects

Overdoses of dilute hydrocyanic acid cause the following symptoms.

1. Nausea and vomiting.
2. Headache.
3. Dizziness.
4. Faintness.
5. Muscular weakness.
6. Slow, weak pulse.
7. Slow, shallow, difficult breathing.
8. Dilated pupils with protruding eyeballs.
9. Occasionally the face becomes bloated.
10. Stupor.

These symptoms disappear when the drug is stopped, and heart and respiratory stimulants administered.

Hydrocyanic Acid Poisoning

Hydrocyanic poisoning usually results when this acid, or any of its salts are taken with suicidal intent, or by the inhalations of its fumes in a chemical laboratory. It is the most powerful poison known.

Symptoms

When a sufficiently large dose is taken, there is a slight convulsion and death results immediately from paralysis of the heart and respiration.

If the dose has not been very large, the following symptoms appear in a few seconds.

1. The patient falls to the ground unconscious.
2. Bloated face and frothing at the mouth.
3. Protruding eyeballs.
4. Dilated pupils.
5. Very slow, shallow and irregular breathing. Often the expiration is prolonged, and followed by a long pause, during which the breathing seems to have stopped.
6. Very weak and irregular pulse.
7. Cyanosis.
8. Odor of acid on the breath.
9. Cold, moist skin.
10. Convulsions with clinching of the muscles of the fingers and toes.
11. Paralysis of the muscles.

Death usually results from paralysis of the respiration, within fifteen minutes.

Treatment

Rapid, vigorous treatment is necessary in order to save the patient. Usually, however, the symptoms appear so rapidly, that death results in spite of the most active treatment. If the patient can be kept alive from about twenty minutes to a half hour, the chances of recovery are increased; as most of the drug is then excreted.

1. Give artificial respiration continuously, as long as the patient is alive. This helps to get rid of the drug by the lungs.
2. Apply cold applications to the head and spine to keep up the breathing.
3. Give iron hydroxide or peroxide of hydrogen to neutralize the acid.
4. Wash out the stomach.
5. Give heart and respiratory stimulants, intravenously, or hypodermically. The best ones to use are: atropine, strychnine, caffeine, ammonia, ether, alcohol, etc.

Preparations

Dilute Hydrocyanic Acid (Acidum Hydrocyanicum Dilutum)	0.1–0.5 c.c.	m. ii–viii

This contains 2% of hydrocyanic acid. It should always be fresh; as it decomposes very easily.

POTASSIUM CYANIDE

Potassium cyanide is a salt formed by potassium with hydrocyanic acid.

ACTION

Local action: Applied to the skin, it causes redness and inflammation. If the skin surface is injured, it may be absorbed and then cause poisonous symptoms.

Internal Action

When potassium cyanide enters the stomach, the acid of the gastric juice decomposes it, and hydrocyanic acid is formed. The effects which are then produced are those of hydrocyanic acid.

Poisonous Effects

The poisonous symptoms of potassium cyanide, are the same as those of hydrocyanic acid, but they appear more slowly and do not cause death so rapidly.

The treatment is the same as for hydrocyanic acid poisoning, but in addition to the other measures used, a weak solution of iron sulphate occasionally neutralizes the effect, by forming prussian blue (potassium ferrocyanide), which is an inactive substance.

Uses

Potassium cyanide is occasionally used as a substitute for hydrocyanic acid. It is frequently used in ½–1% solutions to remove the stains of silver nitrate from the skin.

Preparations

Potassium Cyanide (Potassii Cyanidum)	0.005–0.008 gm.	gr. $\frac{1}{12}$–$\frac{1}{8}$

OXAPHOR (not official)

Oxaphor is a 50% solution of oxycamphor, a derivative of camphor. Its principal effect is to make the breathing slow and shallow.

It is used as a substitute for morphine in asthma, and difficult breathing (dyspnoea) from other causes.

Oxaphor	2.0–3.0 gms.	grs. xxx–xlv

SEDATIVE EXPECTORANTS

The following drugs are used principally to relieve spasmodic cough.

GRINDELIA

Grindelia is obtained from the leaves and flowers of **Grindelia robusta,** and **Grindelia squarrosa,** plants which grow on the western coast of the United States.

ACTION

The principal effects of grindelia are the following:

1. It lessens spasmodic cough by relaxing the contractions of the involuntary muscles of the bronchi.
2. It makes the heart beat slower and weaker, causing a slow and weak pulse.
3. It increases the flow of urine.

Grindelia is excreted mainly by the urine.

Poisonous Effects

Overdoses of grindelia cause the following symptoms:

1. Nausea and vomiting.
2. Slow, weak pulse.
3. Slow, shallow breathing.
4. Subnormal temperature.
5. Stupor.
6. Dilated pupils.

Uses

Grindelia is used to relieve spasmodic cough in whooping cough and asthma. It is also used locally to relieve poison ivy rash.

Preparations

Fluidextract of Grindelia (Fluidextractum Grindeliae)	**1.0–4.0 c.c.**	**m. xv–℥ i**

LOBELIA

Lobelia or Indian tobacco, is occasionally used to relieve the spasmodic cough of whooping cough and asthma. It is a dangerous drug, and the patient should be carefully watched when it is given. Its action will be described under its more important effects. (See page 464.)

CHAPTER XVII

CEREBRAL DEPRESSANTS

Cerebral depressants are drugs which lessen the activity of the brain.

The following drugs lessen the activity of the brain. Some of these drugs lessen all the functions of the brain, while others lessen only some activities, and increase others. For the mode of action of cerebral depressants, see page 231.

THE BROMIDES

The bromides are crystalline salts formed by the combination of an alkali, such as potassium, sodium, ammonia, etc., with hydrobromic acid. This is an acid formed from bromine, an element found in sea water.

(Every salt consists of two parts; the part derived from the alkali, which is called the base; and the part derived from the acid, which is called the acid radicle. For example, in potassium bromide, the potassium is the base, and is derived from the alkali. The bromide is the acid radicle and is derived from the acid. Every salt is decomposed in the body, into its two elements, or ions, as they are called. Each of these elements produces separate and different effects.)

The effects of the bromide are due principally to the acid radicle, or bromide ion. The base of the salt also produces some effects. Each of the various bromides, therefore, produces a somewhat different effect because of the different base with which it is combined. The most active salt of the bromides, is the potassium bromide.

POTASSIUM BROMIDE

Potassium bromide is a salt formed by the combination of potassium, and hydrobromic acid, or by some of their salts.

Appearance of the Patient

About 15 to 20 minutes after an average dose of potassium bromide is taken, the patient complains of a dull headache, he feels tired and weak, and he does not care to exert himself, either mentally or physically. When he moves about, the movements are slow and languid. He perceives objects about him, though not as clearly as usual, but he manifests no interest in them. He speaks slowly, and hesitatingly, in a monotonous tone of voice. He does not express his thoughts clearly; these are slow and confused, and his reasoning and memory are poor. Very often the patient becomes drowsy. The pulse is somewhat slower and weaker, and the breathing is somewhat slower.

If the patient is nervous and excitable, he becomes calm and quiet. If he has tremors or convulsions, these are lessened or prevented.

ACTION

Local action: Applied to the skin, potassium bromide produces no effects. **Mucous membranes,** however, are made somewhat less sensitive.

Internal Action

In the mouth: It has a salty taste, and it makes the throat less sensitive; so that when it is touched, vomiting is not so apt to occur.

In the stomach and intestines: No effect is produced except occasional nausea.

Action after Absorption

Potassium bromide is absorbed through the lining membrane of the stomach, in a few minutes. It is readily absorbed, too, from all mucous membranes. After absorption, it affects principally the nervous system and the heart.

Action on the nervous system: Potassium bromide lessens the activity of the entire nervous system; the brain, the spinal cord and the nerves.

Action on the brain: The activity of the motor areas of the

brain is lessened, so that they send out fewer impulses for motion. The patient then moves about slowly and languidly; he feels weak and does not care to exert himself. Twitchings of the muscles and muscular contractions are therefore lessened.

The activity of the speech area of the brain is lessened. The impulses for speech are then sent out more slowly. This makes the speech slow, hesitating, often indistinct and monotonous.

The sensory areas of the brain are made less active. The patient then sees, hears, and feels objects, less distinctly. The impressions received by the brain through these various senses, are not very vivid. The patient does not then manifest much interest in the objects or activities about him. Since the sensory impressions are less readily received by the brain, consciousness is lessened, and the patient becomes drowsy, or even falls asleep.

The mental activities of the brain are lessened, the memory is indistinct, and the reasoning is poor. Ideas do not arise easily. All the emotions particularly are diminished; so that a nervous, hysterical, emotional individual, often becomes calm and quiet. This helps to produce sleep in such individuals, who often suffer from sleeplessness because of increased nervous activity.

The headache which is often produced by bromides, is due to the strain that ordinary activities of the brain produce in patients under the effect of these drugs.

Action on the spinal cord: Potassium bromide lessens the activity of the spinal cord. The reflex action of the body is therefore lessened. The patient does not then respond readily to external stimuli applied to the skin or mucous membranes. For example, when the conjunctiva of the eye is touched, winking results very slowly. When the pharynx is touched, vomiting is not produced so easily when the patient is under the influence of bromides.

The evacuation of the bladder, which is a reflex act, is often delayed by bromides.

The bromides lessen the sexual activities.

Action on the nerve endings: The sensory nerve endings

become less sensitive after bromides. The patient does not then appreciate the various sensations clearly.

All the above mentioned effects on the nervous system, are due to the bromide part of the salt, and result from any bromide salt, such as sodium potassium, etc.

Action on the heart: Potassium bromide makes the heart beat slower and weaker, causing a slow, weak pulse. This effect is due to the potassium or basic part of the salt. The other bromides do not affect the heart.

Action on the respiration: Potassium bromide makes the breathing slow and shallow. This is probably due to the potassium part of the salt.

Effect on temperature: Owing to the lessened activity of the various organs of the body, the temperature is somewhat lowered, because less heat is produced.

Excretion

The bromides are very slowly eliminated from the body, mainly by the kidneys, the skin (through the sweat glands), and by all the mucous membranes. It usually takes about 24 to 72 hours for the bromides to be excreted, often even weeks and months.

Poisonous Effects

Acute poisoning from the bromides does not occur. Since they are rapidly absorbed, but very slowly excreted in some individuals, some of the bromides which are administered continually for a long time, accumulate in the body, and cause cumulative symptoms, chronic bromide poisoning, or "bromism."

Symptoms of "Bromism"

The symptoms may come on gradually or suddenly. They are due principally to the exaggerated effects of the bromides, and to the effects on the various tissues and organs through which they are excreted. For example, the rashes which occur, are due to the excretion of the drug through the skin.

1. **Skin eruptions.** Principally pimples occurring on the

face (acne). These may often form small abscesses. At other times, there are reddish spots scattered over the skin. The skin is usually pale and anaemic.

2. Loss of appetite, salty taste in the mouth, bad breath, and disturbed digestion.
3. Constipation.
4. Drowsiness.
5. Stupid, dull expression on the face.
6. Depressed spirits, even melancholia.
7. The eyes look heavy and dull.
8. The patient manifests no interest in his surroundings.
9. Slow, uncertain gait.
10. Slow, stammering speech, often words are forgotten and mispronounced.
11. Very poor memory, even recent events are forgotten.
12. Slow pulse.
13. Lessened reflexes, touching the conjunctiva of the eye does not cause winking, etc.

Treatment

When the bromides are stopped, these symptoms gradually disappear. Giving cathartics and hot baths helps to eliminate the drug more easily.

SODIUM BROMIDE

Sodium bromide is a salt formed by the combination of sodium and hydrobromic acid, or some of their salts. It produces the same effects as potassium bromide, but it does not slow the heart and respiration, which effects are due only to the potassium part of potassium bromide.

AMMONIUM BROMIDE

Ammonium bromide is a salt formed by the combination of ammonia with hydrobromic acid, or by the combination of some of their salts. It produces the same effects as potassium bromide, but owing to the ammonium, it makes the pulse and breathing faster.

LITHIUM BROMIDE

Lithium bromide is a salt formed by the combination of lithium and hydrobromic acid, or by the combination of some of their salts. It is not as efficient as the other bromides. Owing to the lithium, it is more apt to upset the stomach, and it is said to increase the flow of urine. It is not so apt to cause cumulative symptoms.

STRONTIUM BROMIDE

This is a salt formed by the combination of strontium with hydrobromic acid, or by the combination of some of their salts. It produces the same effects as the other bromides, but it is more slowly absorbed.

CALCIUM BROMIDE

Calcium bromide is a salt formed by the combination of calcium with hydrobromic acid, or by the combination of some of their salts. It produces the same effects as the other bromides.

DILUTE HYDROBROMIC ACID

Dilute hydrobromic acid is a dilute solution of an acid formed from bromine. It produces the same effects as the bromides, but it is more apt to upset the stomach.

The cumulative symptoms of bromides are the same for all the various bromides.

Uses

The bromides are used to lessen overactivity of the brain in the following conditions.

1. To prevent epileptic convulsions.
2. To relieve the muscular twitchings of chorea ("St. Vitus' dance").
3. To relieve emotionalism, nervousness or excitability in neurasthenia.

4. To produce sleep when the insomnia is due to nervousness.

5. To lessen sexual excitement.

Preparations

Potassium Bromide (Potassii Bromidum)	1.0–4.0 gms.	grs. xv –ʒi
Sodium Bromide (Sodii Bromidum)	1.0–4.0 gms.	grs. xv –ʒi
Ammonium Bromide (Ammonii Bromidum)	1.0–2.0 gms.	grs. xv –xxx
Lithium Bromide (Lithii Bromidum)	1.0–2.0 gms.	grs. xv –xxx
Strontium Bromide (Strontii Bromidum)	2.0–4.0 gms.	grs. xxx–ʒi
Calcium Bromide (Calcii Bromidum)	2.0–4.0 gms.	grs. xxx–ʒi
Dilute Hydrobromic Acid (Acidum Hydrobromicum Dilutum)	2.0–12.0 gms.	grs. xxx–ʒiii

This is a 10% solution of hydrobromic acid. About 7.0 c.c. of this solution is equal to 1.0 gm. of potassium bromide.

Monobromated Camphor (Camphora Monobromata)	0.3–0.6 gm.	grs. v–x

This preparation is used to lessen the excitement of hysteria, neurasthenia and sexual excitement. Its effect is due mainly to the camphor.

New and Non-official Preparations

Adalin	0.3–0.6 gm.	grs. v–x

This is an organic bromide salt (brom diethyl acetylcarbamide). It produces the same effects as the other bromides.

Brometone	0.3 gm.	grs. v

This is an organic bromide salt (acetone bromoform), which is said not to cause cumulative symptoms.

Bromipin or Bromiol	1.3–10.0 gms.	grs. xx–cl

This is a combination of bromine and sesame oil. It

usually comes either in a 10 or 33⅓% solution. It is said not to cause cumulative symptoms. It is given in syrup flavored with peppermint water.

Bromural 0.3–0.6 gm. grs. v–x

This is an organic bromide salt (monobrom-isovaleryl urea). It is used to produce sleep in nervous patients. The sleep usually lasts for three to five hours. It usually comes in tablets, each containing 0.3 gm. (grs. v) each.

Bromo Mangan 4.0–16.0 c.c. ʒ i–iv

This is a compound of iron, manganese, bromine and peptones. It contains about 11% of bromine. It is used to soothe nervousness and to build up nervous patients.

Brovalol 0.25–0.75 gm. grs. iv–xii

This is a compound of a valeric acid salt and bromine. It is used to soothe nervous patients, and is said to be more effectual than either the valerian preparations or the bromides alone.

Sabromin 0.5–4.0 gms. grs. viii–ʒi

This is an organic salt formed by the combination of calcium and dibrombehenic acid. It produces the same effects as the other bromides, but they come on slower and last longer. It is said to have a more pleasant taste and not to upset the stomach. It usually comes in tablets, each containing 0.5 gm. (grs. viii).

The following preparations of the bromides are occasionally used:

Bromocoll 2.0–4.0 gms. ʒ½–i

This contains about 20% of bromine, gelatin and tannic acid.

Bromidia

This contains potassium bromide, chloral hydrate, extract of hyoscyamus, extract of cannabis indica, licorice and oil of orange peel.

ANAESTHETICS

Anaesthetics are drugs used to produce loss of sensations, especially to pain, so as to enable a surgical operation to be performed upon the patient without pain. The anaesthetics are divided into two classes:

1. **General Anaesthetics**
2. **Local Anaesthetics**

General anaesthetics are drugs which produce a loss of all sensations throughout the body. No sensory impulses are then received by the brain, and the patient becomes unconscious.

Local anaesthetics are drugs which abolish sensations only on the particular area of the body where they are applied. Since they do not abolish all sensory impulses, they do not produce unconsciousness.

ETHER (AETHER)

Ether is a colorless liquid formed by the combination of sulphuric acid and alcohol. It evaporates very easily, it is very inflammable and has a very disagreeable odor and a burning taste.

Ether was first used as an anaesthetic by an American dentist, Dr. Morton, in 1842.

It is usually given by inhalation through a mask or specially constructed apparatus, to produce insensibility to pain. Its effects are quite similar to those of alcohol, which was formerly used to produce anaesthesia. Chemically, ether is closely related to alcohol, being formed when alcohol is combined with oxygen.

Appearance of the Patient

Ether Anaesthesia

The most striking effect that is noticed when ether is given to produce anaesthesia, is that the patient struggles and talks a great deal. It is customary, therefore, to divide

the anaesthetic effects of ether, into three stages; depending upon whether the effects occur before the patient struggles, during the time of struggling, or after this stage has occurred. The three stages of ether anaesthesia are:

1. **The stage of imperfect consciousness, or first stage.**
2. **The stage of excitement, or second stage.**
3. **The stage of anaesthesia or complete unconsciousness, or third stage.**

Symptoms of the First Stage of Anaesthesia

The patient has probably undergone various preparations for the operation, and has pictured in his mind various ideas of pain and suffering that the operation might produce. This makes him quite nervous and anxious, and his pulse quite rapid. He therefore regards every act of the doctor or nurse with suspicion. When the mask is applied to the face, the difficulty of obtaining air causes a **choking sensation,** and the inhalation of the ether causes a burning pain in the throat, which often makes them cough and causes a **profuse flow of saliva.** Soon there is a feeling of warmth all over the body and the sensations become dulled. **The sense of touch is blunted, objects are seen through a mist, and sounds appear to be at a distance.** Often **ringing, hissing or roaring sounds** are heard. The muscles become stiff and the arms are held rigid. **The face is flushed,** the pupils are dilated, but they react to light. The pulse is rapid, and the breathing is rapid and irregular on account of the coughing and choking sensation. These effects last for about five or ten minutes and are soon followed by

The Symptoms of the Second Stage or Excitement Stage

This stage begins with **movements of the arms.** The patient tries to push the mask away, and attempts to get up. Many patients **struggle violently,** others **shout, sing, groan,** or **burst into fits of laughter.** These symptoms of excitement seem to result from dreams which the patient seems to have. These dreams vary with the mode of life and the temperament of the individual. Religiously inclined persons may

sing hymns or pray, others become abusive, swear and fight. Some become jolly, laugh and sing, still others become emotional and some have fears of injury and death.

The pulse during this stage is rapid, the skin is flushed, often blue, the breathing is irregular because of the struggling. These symptoms last for a few minutes, the struggling then becomes lessened, the shouting and talking become indistinct, the breathing becomes very shallow and the patient passes into

The Third Stage, or the Stage of Anaesthesia

The patient now becomes calm, quiet and unconscious. All sensibility is gone. **The muscles are relaxed** and the reflexes disappear, so that when the skin is touched or injured, no response or movement is produced. Thus, touching the throat does not cause vomiting. The winking of the eyelids which occurs when the eye is touched, often remains for some time, however.

The pulse still remains rapid and strong, though it is slower than during the first and second stages. **The breathing is deep and rapid** and is often snoring in character. The pupil is usually contracted, and responds to light and accommodation.

This stage of anaesthesia, may be kept up for hours, by judiciously pouring small quantities of ether on the mask.

When the ether is stopped, the patient may again become somewhat excited and talkative, he feels nauseated and vomits. The patient then slowly regains consciousness, often remaining asleep for a few hours before consciousness is regained, and complains of headache and dizziness for hours afterward.

ACTION

Local action: Applied to the skin, ether evaporates so rapidly, that it makes the skin feel cool. It also slightly benumbs the sensation, acting as a mild local anaesthetic. **On mucous membranes:** It causes redness and increases the secretion of mucus.

Internal Action

In the mouth: It has an unpleasant burning taste, and it increases the flow of saliva by the reflex action produced by the redness of the mucous membrane which ether causes.

In the stomach: It increases the secretions of the mucous membrane, and slightly checks the formation of gas (carminative action).

In the intestines: Ether causes redness and swelling of the mucous membrane with profuse secretion of mucus. It is said to destroy intestinal worms (anthelmintic action).

Action after Absorption

Ether is absorbed into the blood in a few minutes, through the mucous membranes of the lungs, stomach or intestines. After absorption it affects principally the brain, the heart and the respiration.

Action on the brain: The effects of ether on the brain, are quite similar to those of alcohol. It first increases the activity of the brain, though lessening the self control, and then it lessens all its activities.

The uncontrolled talkativeness, the constant movements, the dreams occurring in the excitement stage, are all evidences of increased activity of the speech, motor and imaginative centers of the brain. The loss of sensibility, the unconsciousness and the relaxations of all the muscles which follow the excitement stage, and which are present during the stage of anaesthesia, are the result of the diminished activity of the sensory and motor areas of the brain. The unconsciousness results because the appreciation of sensations is lessened.

Action on the spinal cord: The reflex action, which is carried on mostly in the spinal cord, is at first increased, but soon lessened or entirely abolished by ether. Many reflexes, such as the reaction of the pupil to light, the movements resulting when the sphincter is stretched, remain for a long time.

Action on the respiration: Ether makes the breathing faster and deeper. During the excitement stage of anaes-

thesia, however, the breathing may be irregular, because of the struggling, and the contractions of the muscles for breathing.

Action on the lungs: It increases the secretions of the mucous membranes of the bronchi and lungs.

Action on the circulation: Ether makes the heart beat stronger and faster. It contracts the blood vessels and increases the blood pressure.

The characteristic pulse of ether is therefore rapid and strong. During the third stage of anaesthesia, the rate of the pulse is about normal, or a little above normal. As the anaesthesia progresses however, the pulse gradually becomes weaker.

Action on the blood: Ether has a tendency to destroy red blood corpuscles.

Action on the muscles: All the muscles are relaxed by ether, when it is given as an anaesthetic.

Action on the pupil: During the first and second stages of anaesthesia, the pupil is dilated because of the excitement. During the third stage, the pupils are contracted, but they react to light.

Action on the kidney: Ether is somewhat injurious to the kidney. It often causes albumin in the urine, after a prolonged anaesthesia.

Excretion

Ether is very rapidly eliminated from the body, by the expired air of the lungs, usually in about a half an hour. When given as an anaesthetic, it is entirely excreted in about 24 hours; though the breath has its unpleasant odor during that time.

Idiosyncrasies

The most common variations in the effects of ether are the following:

1. In some individuals, and in children, there may be no excitement stage.
2. Patients who have been used to taking alcoholic liquors

regularly, require larger quantities of ether to produce anaesthesia. These patients usually struggle a great deal.

3. In some individuals, very small quantities may cause poisonous effects.

Poisonous Effects or " Ether Collapse "

Acute ether poisoning or ether collapse, usually results when too much ether is given to produce anaesthesia.

Symptoms

1. The first symptom which indicates that too much ether is being administered, is **slow, shallow and gasping breathing.**

2. The face then becomes blue and cyanotic and the breathing stops.

3. The pulse may not become affected, but it soon becomes weak and irregular.

4. The pupils are widely dilated, and do not react to light. The pulse gradually grows weaker, and death finally results from respiratory paralysis.

Treatment

1. Stop anaesthesia; take the mask away.
2. Give artificial respiration.
3. Elevate the foot of the table.
4. Stretch the sphincter of the rectum to induce breathing by the reflex action thus produced.
5. Give heart and respiratory stimulants such as caffeine, strychnine, atropine, etc.

Usually, if the collapse is recognized early, these measures will revive the patient.

Dangers of Ether Anaesthesia

The following symptoms occurring during anaesthesia often warn the anaesthetist of impending trouble.

1. Slow, shallow breathing.
2. Dilated pupils which do not react to light.
3. Slow, weak, irregular pulse.

4. Often the relaxed muscles of the tongue, cause the tongue to fall back and obstruct the breathing.

5. In some cases, continued vomiting of the contents of the stomach and intestines, during deep anaesthesia, may cause food particles to enter the lungs and cause asphyxia. This can be avoided by constantly keeping the mouth thoroughly mopped out.

Dangers Following Anaesthesia

The most common condition that may occur after ether anaesthesia is pneumonia. This may result from the injurious effect of ether on the lungs.

Preparations for Anaesthesia

Before administering ether, the following measures should always be carried out, but the nurse must receive these orders from the surgeon.

1. Move the bowels by a cathartic, about twelve hours before the operation, and give an enema the morning of the day the patient is to be operated upon.

2. Do not give any food or drink for about twelve hours before the operation. This often lessens the vomiting after the anaesthesia.

3. Catheterize the patient before the operation.

4. **Remove all false teeth,** so that the patient will not swallow them during the anaesthesia.

5. When the anaesthesia is begun, the eyes should be covered with a piece of gauze, and the face protected with vaseline to avoid the injurious effects of the ether fumes.

Administration

To produce anaesthesia, ether is given by inhalation through a mask held over the nose and mouth, in the following ways.

The Open Method or Drop Method

The ether is poured drop by drop on a mask covered with gauze, and the patient is then allowed to inhale the ether

vapor which is thoroughly mixed with air. This is the most common method of administration now in use.

The Closed Mask Method

This method is gradually being abandoned. The ether is given through a cone saturated with ether, but it is mixed with very little air.

There are numerous apparatus for giving ether, many of which have various advantages, such as warming the vapor, etc.

Gas Ether Method

This is a very common method now in vogue, whereby the patient is first given nitrous oxide gas, and then ether. In this way, many of the unpleasant effects of ether, and the excitement stage, are avoided.

Ether is also occasionally given as an anaesthetic by the rectum, by means of a specially constructed apparatus.

Recently, a method has been devised for producing anaesthesia by giving ether intravenously. The ether is given in an intravenous infusion of salt solution.

In giving an anaesthetic, it is important that the drug be administered very slowly, and the breathing and pulse should be watched very carefully throughout the anaesthesia. In this way, the serious dangers are avoided.

Uses

Beside its use as an anaesthetic, ether is used

1. As a heart stimulant.
2. To check convulsions.
3. As a carminative, to lessen the formation of gas in the stomach and intestines.

Preparations

Ether (Aether)	0.5–1.0 c.c.	m. viii–xv

This contains 96% of ether, and is used principally as an anaesthetic. The dose of ether for anaesthesia varies with the patient, and the degree of anaesthesia desired.

Spirits of Ether (Spiritus Aetheris)	2.0–4.0 c.c.	$3\frac{1}{2}$–i

This consists of 32 parts of ether and 68 parts of alcohol.

Compound Spirits of Ether (Spiritus Aetheris Compositus) (Hoffman's Anodyne)	2.0–4.0 c.c.	3½–1

This contains 32% of ether, alcohol and other substances known as ethereal oils. It is used principally to check the formation of gas in the stomach and intestines, and as a remedy for fainting. It is usually diluted with cold or iced water.

Spirits of Nitrous Ether (Spiritus Aetheris Nitrosi) (Sweet Spirit of Niter)	1.0–4.0 c.c.	m. xv–3i

This preparation is used to increase the perspiration and the flow of urine, but it also causes the same stimulating effects as ether.

CHLOROFORM

Chloroform is a colorless non-inflammable fluid, which evaporates easily, but not as rapidly as ether. It is formed by the combination of alcohol with chlorine. Chemically, it is a compound of methane (marsh gas) with chlorine forming trichlor methane or chloroform. It is used principally as an anaesthetic.

Chloroform Anaesthesia

When chloroform is given as an anaesthetic, the symptoms it produces can be divided into three stages as in ether anaesthesia.

During the first stage, the patient is nervous, anxious, and his sensations are dulled, but the anaesthetic is more pleasant to take than ether. The pulse is usually rapid.

Very soon, the second stage sets in, the excitement, talkativeness and struggling, however, are usually much less, and last for a shorter time than with ether. **This stage is very often entirely absent.**

The stage of anaesthesia, or third stage, comes on very rapidly with chloroform. The patient is calm, quiet and unconscious. **The breathing is slow and shallow, the rate of**

the pulse is normal, perhaps somewhat slower but weak. The face is pale, and the pupils are contracted, but they react to light. All sensibility and reflex action are gone, and the muscles are relaxed.

With chloroform, anaesthesia is induced much quicker than with ether, usually in about five or ten minutes. The muscles become relaxed sooner, the pulse is weak and slower and the breathing is shallow.

ACTION

Local action: Applied to the skin, the sensibility is somewhat lessened by chloroform, and it causes redness and a burning sensation. If it is prevented from evaporating, it may form a blister. **On mucous membranes:** It causes redness and increases the secretion.

Internal Action

In the mouth: It has a hot sweetish taste and it increases the flow of saliva.

In the stomach: It causes a feeling of warmth and checks the formation of gas (carminative action). It increases the secretion of the mucous membranes of the stomach and the peristalsis.

In the intestines: If given in large doses, the secretions and peristalsis of the intestines are both increased.

Action after Absorption

Chloroform is absorbed into the blood through the mucous membrane of the stomach in about fifteen minutes; when given by mouth. When inhaled as an anaesthetic, it enters the blood from the mucous membrane of the lungs still more rapidly. It is also readily absorbed through all the mucous membranes. After absorption it affects principally the brain, the heart and the respiration.

Action on the brain: Chloroform produces the same effects on the brain as ether does. It increases its activity at first, but soon lessens it. The result of this action, is a preliminary stage of excitement and talkativeness, followed

by unconsciousness, loss of sensation and relaxation of the muscles.

Action on the spinal cord: Chloroform at first increases, and then lessens the reflex action throughout the body.

Action on the respiration: It makes the breathing slower and shallower.

Action on the lungs: Chloroform does not increase the secretion of the lungs as much as ether does.

Action on the circulation: Chloroform makes the heart beat slower and weaker, by weakening the contractions of the heart muscle. It widens the blood vessels and lowers the blood pressure. **The chloroform pulse is slow and weak.**

Action on the blood: Chloroform has a tendency to destroy red blood corpuscles.

Action on the pupil: The pupil is contracted, but it reacts to light and accommodation.

Action on the muscles: Chloroform relaxes all the muscles of the body.

Action on the kidney: It is distinctly injurious to the kidney, and changes some of the constituents of the kidney cells to fat. It often causes albumin in the urine.

Excretion

Chloroform is rapidly eliminated, mainly by the expired air of the lungs; though some of it is also excreted by the urine and the perspiration.

Poisonous Effects

Chloroform poisoning occurs in two forms:

1. **Acute Chloroform Poisoning**
2. **Delayed Chloroform Poisoning**

Acute Chloroform Poisoning

Acute chloroform poisoning usually results when too much chloroform is given as an anaesthetic; or in susceptible individuals, from very small quantities; even as little as a few drops.

Sudden Chloroform Death

Sudden death occasionally occurs from chloroform, in susceptible individuals, even when only a few drops are administered for anaesthesia.

This occurs usually during the first stage of anaesthesia. **The pulse becomes very slow and weak, the face turns pale, the breathing becomes very shallow and slow, the pupils are widely dilated, and the patient dies in a few minutes.**

This very unfortunate occurrence, is the result of the coughing and burning pains in the throat which occur during the first stage of anaesthesia. Impulses are thus sent to the Vagus center in the medulla, which then sends impulses to the heart to make it beat slower. (Reflex action.)

Such impulses usually cause fainting, which is a condition where the heart stops beating for a few moments, but soon recovers again. In sudden chloroform death, however, the heart muscle is poisoned by the chloroform; so that it does not contract again, after it has suddenly stopped beating, and death results.

If atropine is given before chloroform anaesthesia, it occasionally acts as a safeguard against this dreaded accident. The atropine paralyzes the nerve endings of the Vagus nerve in the heart, and prevents impulses to slow the heart contractions, from reaching it.

When this accident occurs, it is usually treated by giving atropine and other heart stimulants hypodermically, and massaging the chest over the heart. Every now and then the patient recovers after vigorous treatment.

Symptoms of Chloroform Collapse

When too much chloroform is given during anaesthesia, the following symptoms usually result, in the order of their onset.

1. The pulse becomes slow, weak and irregular, usually about 50 or 40 to the minute.
2. Slow and shallow breathing.
3. Face is pale.
4. The pupils are widely dilated, and do not react to light or accommodation.

5. The pulse and breathing become still slower, and the patient dies from paralysis of the heart.

Treatment

1. Stop the anaesthesia, and take the mask away as soon as the slow and weak character of the pulse is noticed.
2. Give heart stimulants such as atropine, caffeine, strychnine, etc.
3. Give artificial respiration.
4. Elevate the foot of the table.

Delayed Chloroform Poisoning

This form of chloroform poisoning occurs occasionally, and the symptoms appear about a few days after the anaesthetic has been administered. It is due to the destruction of many of the cells of the liver, kidney, and heart, which then become filled up with fat globules. (Fatty degeneration.)

Symptoms

1. Nausea and vomiting, the vomited matter containing bile.
2. Jaundice.
3. Delirium.
4. Convulsions.
5. Scanty urine, which contains albumin, and two substances characteristic of this condition, **leucin** and **tyrosin**.
6. Collapse (slow, weak pulse, slow, shallow breathing, etc.).

The patient usually dies in a few days from profound collapse.

Administration

Chloroform is usually given by inhalation, by means of a mask covered with gauze, which is held over the patient's nose and mouth. A few drops of chloroform are poured on the mask and allowed to mix thoroughly with air. Dangers of chloroform are best avoided, by pouring the chloroform very slowly, a drop at a time, and allowing the vapor to thoroughly mix with air.

The nurse is often called upon to give chloroform during labor, in obstetrical cases. Very little chloroform should then be given, as it is necessary in such cases, to administer the chloroform only when the patient has severe pains. Complete anaesthesia is not desired in these cases, as the uterine contractions are then lessened, and the birth of the child is thus retarded. The pulse and breathing should be watched very carefully throughout the anaesthesia.

Uses

Beside its use as an anaesthetic, chloroform is given:

1. To stop convulsions (by inhalation).
2. To check diarrhoea and to lessen colic (by internal administration).
3. Chloroform liniment is frequently used as a local application to relieve pain.

Preparations

For Internal Use:

Chloroform (Chloroformum)	0.06–1.0 c.c.	m. i–xv

The dose of chloroform for anaesthesia, varies with the patient, and the degree of anaesthesia desired.

Chloroform should always be kept in brown bottles, as it readily decomposes into dangerous substances, by the action of light.

Spirits of Chloroform (Spiritus Chloroformi)	2.0–4.0 c.c.	m. xxx–ʒ i

This contains 10% of chloroform.

Emulsion of Chloroform (Emulsum Chloroformi)	15.0–30.0 c.c.	ʒ ½–i

This contains 4% of chloroform.

Chlorodyne (Not official)	0.3–2.0 c.c.	m. v–xxx

This contains chloroform, ether, hydrocyanic acid, morphine and cannabis indica.

For Local Use:
Chloroform Liniment
(Linimentum Chloroformi)

This consists of soap liniment and chloroform, and contains 30% of chloroform.

Compound Chloroform Liniment (not official)
(Linimentum Chloroformi Compositus)

This contains chloroform, oil of turpentine, laudanum, tincture of aconite, and soap liniment.

COMPARATIVE ACTION OF ETHER AND CHLOROFORM

ETHER	CHLOROFORM
1. Inflammable	1. Not inflammable
2. Cools the skin	2. Burns the skin
3. Unpleasant to take	3. More pleasant to take
4. Anaesthesia induced with larger quantities, and not as deep.	4. Deeper anaesthesia induced with smaller quantities.
5. Marked excitement stage	5. Little or no excitement stage
6. Pulse rapid and strong	6. Pulse slow and weak
7. Skin bright red in color	7. Skin pale
8. Suitable in cases where the heart action is weak or where the kidneys are diseased.	8. Suitable in cases where the lungs are diseased or in drunkards.
Dangers	
9. Respiratory collapse	9. Cardiac collapse
After Effects	
10. More vomiting	10. Less vomiting
11. Apt to cause pneumonia	11. Apt to cause delayed chloroform poisoning

ETHYL BROMIDE (AETHYLIC BROMIDUM) (not official)

Ethyl bromide or bromide of ether, is a colorless liquid which evaporates easily. It has a disagreeable, sweetish taste, and an ethereal odor.

ACTION

Ethyl bromide is used to produce anaesthesia, especially for short operations, or to begin an ether anaesthesia. Its effects are similar to those of chloroform, and it has the same weakening action on the heart. When its administration is stopped, consciousness returns very quickly, and the patient feels quite weak. It is usually given as a concentrated vapor, mixed with very little air.

It should be kept in brown bottles, as it is decomposed very easily by the action of light, forming dangerous substances.

ETHYL CHLORIDE (AETHYLIC CHLORIDUM)

Ethyl chloride, chloride of ether or kelene, is formed by the action of hydrochloric acid gas on alcohol. It evaporates very easily. It usually comes in special glass containers, with a long, pointed end, which is broken off or unscrewed. A fine stream of vapor then shoots out, which is directed on the skin or on the mask.

ACTION

Local action: Because it evaporates very easily, ethyl chloride freezes the skin over which it is applied, producing local anaesthesia of the part. Minor surgical operations can be performed under this local anaesthesia. It should be applied until the tissues become white and hard, when it should be stopped; if it is continued after this, it is apt to injure the tissues.

General Action

Ethyl bromide is also used as a general anaesthetic. It produces anaesthesia very rapidly, usually in about 1 to 5 minutes.

Its effects are similar to those of chloroform, but it does not cause complete muscular relaxation. **The pulse is slow and weak,** and the breathing is deep. The patient usually recovers from the effects very rapidly. It is usually given to begin anaesthesia, and it is not suitable for prolonged use, because it weakens the heart even more than chloroform and it does not cause complete muscular relaxation.

PENTAL

Pental is a colorless liquid made from fusel oil. Chemically it is trimethylethylene.

It has been used to produce anaesthesia for short operations, and it produces no after effects. Its effects are similar to those of ether or chloroform, but it does not cause much muscular relaxation. It has no effect on the heart or respiration. It occasionally causes twitchings of the muscles, or convulsions, even during anaesthesia.

METHYLENE BICHLORIDE (not official)

Methylene bichloride is an inflammable, colorless fluid which has an odor like chloroform. Its effects are similar to those of chloroform. It produces rapid anaesthesia which soon wears off. It slows and weakens the heart action.

ANAESTHETIC MIXTURES

The following preparations are mixtures of various anaesthetics. They are said to have various advantages over a single anaesthetic.

A. C. E. MIXTURE

This consists of

Alcohol	1	
Ether	2	Parts by volume
Chloroform	3	

ANAESTHOL

This is a mixture of

Chloroform	36%
Ether	47%
Ethyl Chloride	17%

This mixture is said to have the same boiling point as the blood, and therefore to be easily excreted. The dangers of chloroform are thus said to be avoided.

When these mixtures are given, the ether and the ethyl chloride evaporate more quickly than the chloroform.

The anaesthetist is then giving concentrated chloroform, instead of a diluted mixture. Dangerous symptoms are thus more apt to follow, especially in warm weather, since the ether and other ingredients evaporate more easily than the chloroform.

SOMNOFORM

This is a mixture of

Ethyl Chloride 65%
Ethyl Bromide 5%
Methyl Chloride 30%

NITROUS OXIDE GAS (LAUGHING GAS)

Nitrous oxide gas is a colorless gas without any odor. It is made by distilling ammonium nitrate. The gas is passed through water, and collected in small metal cylinders, in which it usually comes for practical use. It is the safest and most pleasant anaesthetic known.

Appearance of the Patient Nitrous Oxide Anaesthesia

A few seconds after inhaling nitrous oxide gas, the patient usually feels **rushing, drumming or hammering noises in the ears,** the sight becomes indistinct, and he has a feeling of warmth and comfort all over the body. **The arms and legs move constantly about,** the patient is **bright, lively, very jolly, and bursts out into fits of laughter** (hence the name "laughing gas"). These symptoms last for about 2 or 3 minutes and then the patient feels drowsy, falls asleep, and loses all sensibility.

During the anaesthesia, the **face is dark red in color, often blue, the breathing is deep and snoring in character,** the pulse is slow, strong and tense, and **the blood pressure is very high.** If the nitrous oxide is judiciously mixed with air, the anaesthesia can be kept up for a half to one hour.

As soon as the mask is taken away, however, the patient becomes conscious in about 1 to 3 minutes, and has no after effects, except perhaps a slight headache, which may persist for a few hours.

Nitrous oxide does not relax the muscles, so that prolonged abdominal operations cannot be performed under its anaesthesia.

ACTION

Nitrous oxide is a gas which is only given by inhalation to produce anaesthesia. It is absorbed into the blood from the lungs almost immediately. The symptoms which it produces are due to its action on the brain, the blood and respiration.

Action on the brain: The noises in the ears, the movements of the extremities, the laughter, are all evidences of increased activity of the brain. These symptoms last for a few minutes and are almost immediately followed by symptoms of lessened brain activity; such as sleep and loss of sensation.

Action on the respiration: Nitrous oxide gas, by taking the place of oxygen in the lungs and in the blood, prevents the haemoglobin from obtaining its necessary oxygen. The patient then suffers from asphyxia. This makes **the breathing deep and snoring in character** (stertorous), **and the blood becomes blue in color** so that the face has a purple or blue color during anaesthesia.

Action on the heart: The slow, strong pulse and high blood pressure are the result of the asphyxia, and are not due to any effect on the heart or blood vessels.

Excretion

Nitrous oxide gas is eliminated from the body in a few minutes by the expired air.

Poisonous Effects

When too much nitrous oxide is given, the following symptoms are produced, because the haemoglobin is unable to obtain its necessary oxygen. The blood is then impure and is poisonous to the brain and other organs of the body.

Symptoms

1. The face is blue in color.

2. The breathing is difficult and deep.
3. Slow, strong pulse, with very high blood pressure.
4. Convulsions.

These symptoms disappear as soon as the nitrous oxide is stopped.

Administration

Nitrous oxide gas is usually given by inhalation, by means of a specially constructed apparatus, consisting of a mask attached to a large rubber bag, which is filled with the gas from a metal container.

Uses

Nitrous oxide gas is used to produce anaesthesia for short surgical operations, and to begin ether anaesthesia, so as to avoid its unpleasant symptoms and excitement stage.

LOCAL ANAESTHETICS

The following drugs are used to produce insensibility to pain, or anaesthesia, only on the tissues over which they are applied. Drugs which produce such an effect, are called **local anaesthetics.**

Many of the local anaesthetics are applied directly to the surface of the skin or mucous membranes, while others are injected underneath the skin (hypodermically).

LOCAL ANAESTHETICS USED BY DIRECT APPLICATION

ETHER

Ether is rarely used as a local anaesthetic, as its local effects last only for a very short time. It cools the skin by rapidly evaporating, and makes it insensible to pain.

ETHYL CHLORIDE

Ethyl chloride is most commonly used as a local anaesthetic. It is usually sprayed on the skin, by means of a special glass container. It freezes the area over which it is sprayed by its very rapid evaporation, thereby producing

local anaesthesia. The spraying should be stopped when the skin becomes white and hard, as it may injure the tissues if continued further.

MENTHOL

Menthol is a camphor-like substance (stearoptene) obtained from the **oil of peppermint.** It produces a feeling of coolness on the skin and mucous membranes, and produces local anaesthesia. The anaesthesia is not sufficiently marked, however, to enable a surgical operation to be performed. It is used principally to relieve painful conditions of the skin.

Guiacol
Tincture of Aconite
Veratine
} also cause local anaesthesia, but are rarely used for this purpose.

LOCAL ANAESTHETICS GIVEN PRINCIPALLY BY HYPODERMIC INJECTION

COCAINE

Cocaine is the best drug for local anaesthesia. It is readily absorbed into the blood, however, and may then cause poisonous symptoms. To avoid these, it should be remembered, that the total amount of any solution of cocaine to be injected, must not contain more than 0.03 gm. (gr. ½) of cocaine hydrochloride, which is its maximum dose.

As a local anaesthetic, cocaine is given in the following ways:

1. On mucous membranes, such as the nose, throat or larynx, it is applied with a cotton applicator. A 10 or 20% solution is used for this purpose.

Occasionally a few drops of a solution of cocaine crystals dissolved in adrenalin, are used. This contracts the blood vessels very markedly and prevents the absorption of the cocaine and at the same time produces a maximum anaesthetic effect.

2. Infiltration anaesthesia. This is a method of inject-

ing cocaine in very weak solutions; such as a 1–1000 to ½% solution. For large areas, large quantities of weaker solutions may be used. For small areas, stronger solutions such as 4% may be used. To avoid poisonous effects, the cocaine is often injected together with adrenalin chloride solutions. There are numerous preparations made up in this way. The most common of these are

Braun's Solution

This consists of

Cocaine hydrochloride	0.5–0.1
Sodium chloride	10.0–100.0
Adrenalin chloride solution	0.3–0.6

Schleich's Solution

This is made by dissolving 3 tablets, each of which contains

Cocaine hydrochloride	0.03
Morphine hydrochloride	0.008
Sodium chloride	0.06

in 100 c.c. of water.

Cocaine absorption is often prevented by tying a tight bandage around the part to be anaesthetized, so as to contract its blood vessels.

3. Cocaine is also occasionally injected into the nerve leading from the part to be operated upon. This lessens the sensibility of the area from which the nerve fibers come.

EUCAINE

Eucaine is an artificial alkaloid which is used as a local anaesthetic. It produces local anaesthesia like cocaine. It differs from cocaine, however, in the following ways.

1. It does not contract the blood vessels.

2. It slows and weakens the contractions of the heart, by directly affecting the heart muscle, thereby causing a slow, weak pulse, with low blood pressure.

3. It does not dilate the pupil.

Administration

For local anaesthesia in the eye, it is used in a ½% solution. On other mucous membranes, it is applied in 2–10% solutions.

For infiltration anaesthesia, it is used in a 1–500 to 1% solution.

Eucaine is not as poisonous as cocaine, and it can be boiled.

It is also often used in the form of an ointment for painful haemorrhoids.

Preparations

Eucaine is called beta eucaine, to distinguish it from alpha eucaine which was formerly used as a local anaesthetic, but because of dangerous symptoms which it produces, it has now been given up.

Beta Eucaine Hydrochloride
(Beta Eucaine Hydrochloridum)

Beta Eucaine Lactate
(Beta Eucainae Lactas)

This is more soluble than the hydrochloride.

TROPACOCAINE

Tropacocaine is an alkaloid obtained from the leaves of the coca plant of Java. It is usually made artificially, however.

ACTION

Tropacocaine is used principally to produce local anaesthesia. Its effects are similar to those of cocaine, but they come on sooner, and last longer than with cocaine. It does not dilate the pupil as much as cocaine.

Preparations

Tropacocaine Hydrochloride	0.03–0.06 gm.	gr. ½–i
(Tropacocainae Hydrochloridum)		

It is used principally in 3–10% solutions.

HOLOCAIN

Holocain is an artificial alkaloid made from phenacetin. Its effects are similar to those of cocaine, but they appear sooner. It is also an antiseptic. It occasionally causes poisonous symptoms.

Preparations

Holocain Hydrochloride
(Holocainae Hydrochloridum)

It is principally used in a 1% solution as a local anaesthetic in the eye.

NOVOCAINE

Novocaine is an artificial alkaloid which is used as a local anaesthetic. It acts like cocaine, but it is less poisonous and its effects wear off quickly. It is usually given together with adrenalin.

Preparations

Novocaine Tablets Each tablet contains 0.02–0.2 gm. grs. ⅓–iii

There are also tablets containing novocaine and adrenalin.

Novocaine Nitrate 0.02–0.2 gm. grs. ⅓–iii
(Novocainae Nitras)

It is usually used in a 3% solution.

ALYPIN

Alypin is an artificial alkaloid which is used as a local anaesthetic. It is supposed not to produce poisonous symptoms.

It is used principally as a local anaesthetic for eye operations, and in the urethra and bladder, before passing instruments into these organs.

In the eye it is used in 1–2% solutions. On other mucous membranes, it is used in 1–10% solutions.

Preparations

Alypin Tablets Each tablet contains 0.02–0.2 gm. grs. ⅓–iii

STOVAINE

Stovaine is an artificial alkaloid which is used principally as a local anaesthetic and for spinal anaesthesia. Its effects are similar to those of cocaine with the following differences:

1. It dilates the blood vessels.
2. It is less poisonous than cocaine.

In the eye it is used in a 4% solution. On other mucous membranes, in a 5–10% solution. Hypodermically, it is used in a ½–1% solution.

Preparations

Stovaine (in pills) each containing 0.002 gm. gr. $\frac{1}{30}$.

ORTHOFORM

Orthoform is an artificial chemical substance formed by the combination of methyl alcohol and amidoxybenzoic acid (such a combination of an alcohol and an acid is called an ester).

It is used as a local anaesthetic like cocaine, but since it is very slowly absorbed, it produces no general effects and no poisonous symptoms. It is not used hypodermically. It is used principally to relieve pain on a wounded surface and on mucous membranes. It is often used to relieve the pain of an ulcer in the stomach.

Preparations

Orthoform New	0.5–1.0 gm.	grs. viii–xv

It is often applied on wounds in the form of a dusting powder or as an ointment.

ANAESTHESIN

Anaesthesin is a chemical substance used as a local anaesthetic. It is an ester of alcohol and paramidobenzoic acid.

ACTION

The effects of anaesthesin are similar to those of cocaine.

It produces local anaesthesia, but no general effects, as it does not dissolve readily and is not absorbed.

It is used internally to relieve the pain of ulcers in the stomach or of cancer of the stomach. It is also applied to relieve pain on the mucous membrane of the nose, throat, urethra, etc., and on wounded surfaces.

Preparations

Anaesthesin	0.3–0.5 gm.	grs. v–viii

It is also used in the form of a powder or an ointment.

Cycloform	0.1–0.2 gm.	grs. i½–iii

It produces the same effects as anaesthesin, but is somewhat antiseptic.

Propaesin	0.25–0.5 gm.	grs. iv–viii

This acts like anaesthesin and it also contracts the mucous membrane. It is often used in 1–20% ointments.

SPINAL ANAESTHESIA

Anaesthesia is often produced by injecting a solution of one of the local anaesthetics into the spinal canal. The solution is very slowly injected by means of a hypodermic syringe with a specially constructed needle which is inserted into the spinal canal between two of the vertebrae. This produces anaesthesia in about 15 to 20 minutes over the entire surface of the body below the level of the point of injection. The effect produced is due to the action of the drug on the nerve trunks which enter the spinal cord.

The drugs principally used for this purpose are cocaine, tropacocaine, and stovaine. Dangerous symptoms and even death may result from this method of anaesthesia.

HYPNOTICS

Hypnotics, soporifics, narcotics, or somnifacients, are drugs which lessen the activity of the brain, thereby producing sleep, or unconsciousness.

Their effects are similar to those produced by the general anaesthetics, but they are milder and more lasting.

The hypnotics are usually given by the mouth, and are slowly absorbed, their effects lasting for several hours.

Mode of Action

Our consciousness depends upon the impulses received from our surroundings through the various senses. Hypnotics, by lessening the activity of the brain, lessen also the activity of its sensory areas, so that fewer impulses are received from our environments, and unconsciousness or sleep results.

When the activity of the sensory areas is lessened, the appreciation of pain, one of the sensations, is also lessened; so that many of the hypnotics relieve pain (Anodyne action) as well as produce sleep.

The most efficient drug used as a hypnotic is chloral.

CHLORAL

Chloral is an oily, colorless liquid made by the combination of chlorine gas with absolute alcohol. It is not used in medicine, but when it is combined with water, it forms crystals of **chloral hydrate,** which is the preparation ordinarily used.

Appearance of the Patient

About 5 to 15 minutes after an average dose of chloral hydrate is given, the patient feels tired and drowsy, and soon falls asleep. The sleep lasts for about five to eight hours. It resembles the natural sleep, and the patient can be easily awakened; by pain, loud sounds, or when touched. During the sleep, the pulse and breathing are slow, and the pupils are contracted.

When the patient awakes, he may complain of a little headache and dizziness, and may be a little confused.

ACTION

Local action: Applied to the skin, chloral causes redness and even blisters. It also has an antiseptic action, checking the growth of bacteria. On mucous membranes it causes redness and increases the secretions.

Internal Action

In the mouth it has a hot, burning taste.

In the stomach and intestines: It increases the secretions. It occasionally causes nausea and vomiting.

Action after Absorption

Chloral is very rapidly absorbed into the blood through the mucous membrane of the stomach; usually in about 5 to 15 minutes. After absorption, it affects principally the brain, the heart, and respiration.

Action on the brain: Chloral lessens the activity of the brain. The sensory areas of the brain are particularly affected; so that the brain does not appreciate the impulses received through the various senses, and unconsciousness or sleep then results. Very intense sensations, such as pain, are appreciated, however, and these may even prevent sleep. Chloral also lessens the motor activities of the brain.

Action on the spinal cord: The reflex actions of the spinal cord are lessened by chloral. External stimuli therefore produce little response.

Action on the heart: Chloral makes the heart beat slower and weaker by weakening the contractions of the heart muscle. **The pulse then becomes slower and weaker.**

Action on the respiration: The breathing becomes somewhat slower and shallower, because fewer impulses for breathing are sent out from the respiratory center in the medulla.

Effect on the temperature: Chloral lowers the temperature several degrees by lessening the muscular movements; so that less heat is produced.

Excretion

Chloral is eliminated from the body mainly by the kidneys in about several hours, as urochloralic acid.

Idiosyncrasies

Chloral often causes the following unusual effects:

1. Redness and swelling of the conjunctiva of the eye.
2. Flushed face and neck.
3. Eruptions of large, red areas of skin, which are often distinctly raised above the surface (wheals). The eruptions often peel (desquamate).
4. Dyspnoea.
5. Rise of temperature.

Dangerous Symptoms

Chloral Collapse

In giving chloral, the patient must be carefully watched, and the pulse should be taken very frequently, as sudden heart failure from chloral is not at all uncommon, even from a single dose.

Symptoms

1. Restlessness.
2. Slow, weak pulse, about 50 to 40 to the minute.
3. Slow, shallow breathing.
4. Coma.

The chloral should be stopped when these symptoms disappear.

The danger is usually over when the pulse is above 60 and is regular and strong.

Tolerance

If chloral is taken habitually, the patient becomes accustomed to the drug, so that large doses may be taken without producing any poisonous effects.

Poisonous Effects

Acute chloral poisoning is a condition which occasionally results from the administration of an overdose of chloral in alcohol ("knockout drops"). The same symptoms occur when an overdose of chloral is given medicinally.

Symptoms

1. Very deep sleep from which the patient is aroused with difficulty. (Stupor.)
2. Very slow and shallow breathing.
3. Slow, weak, irregular pulse with low blood pressure.
4. Insensibility to pain.
5. Contracted pupils.

With larger amounts, these symptoms are followed by:

1. Coma (deep sleep from which the patient cannot be awakened).
2. Relaxation of the muscles.
3. Very rapid, thready and irregular pulse.
4. Dilated pupils.

Death usually results from paralysis of the heart and breathing. The smallest fatal dose is 2.0 gms. (grs. xxx).

Treatment

1. Wash out the stomach.
2. Give artificial respiration.
3. Keep the patient warm.
4. Give atropine, caffeine, strong coffee, or alcohol; to increase the action of the heart and respiration.

Chloral Habit

Habitual use of chloral often causes symptoms resembling those of the opium habit or chronic alcoholism. It changes into fat globules, many of the constituents of the cells of the various organs of the body, such as the liver and kidney. The following symptoms usually result from this condition.

1. The patient feels melancholic and "blue."
2. Wakefulness and nervousness at night.
3. Loss of appetite and disturbed digestion.
4. Various eruptions on the body.

If the drug is suddenly stopped, symptoms resembling delirium tremens result. To relieve these symptoms, the patient must be gradually weaned of the habit.

Uses

Chloral is used principally:

1. To produce sleep.
2. To lessen the excitement of delirium tremens and other similar conditions.
3. To prevent the convulsions of strychnine poisoning, epilepsy, uraemia, etc.

Administration

Chloral hydrate is best given only slightly diluted in syrup, about 15 minutes to a half hour before bedtime.

Preparations

Chloral Hydrate (Chloralum Hydratum)	0.6–2.0 gms.	grs. x–xxx
Croton Chloral Hydrate or **Butyl Chloral Hydrate**	0.3–1.3 gm.	grs. v–xx

This resembles chloral in its effects; it is not as efficient but the effects are more lasting. It lessens particularly, the sensations carried from the face by branches of the fifth cranial nerve. It is therefore frequently used to relieve the intense pain of trifacial neuralgia ("tic douleureux.")

Metachloral (not official)

This is a substance made by the action of sulphuric acid on chloral. It is used as a local anaesthetic.

Bromal Hydrate (not official) 0.12–0.3 gm. grs. ii–v

This substance is formed by the action of bromine on alcohol. It acts like chloral, but is more dangerous.

Chloral Camphor: This consists of equal parts of chloral and camphor and is used as a local application to relieve pain.

CHLORALFORMAMID

Chloralformamid is a white, crystalline powder with a slightly bitter taste. It is a chemical compound of chloral.

It produces sleep, and its effects are similar to those of chloral. It does not weaken the heart action, but it is not as reliable as chloral.

Preparations

Chloralformamid	1.0–2.0 gms.	grs. xv–xxx

It is usually given in powder form dissolved in whiskey.

CHLORALOSE (not official)

Chloralose is a white, crystalline powder having a bitter taste. It is a compound of chloral and glucose (grape-sugar).

It produces sleep; its effects are similar to those of chloral, but it is not as reliable.

Preparations

Chloralose	0.3–0.6 gm.	grs. v–x

PARALDEHYDE

Paraldehyde is a colorless liquid having a peculiar, unpleasant taste and odor. It is an oxidation product of alcohol.

Appearance of the Patient

A few minutes after an average dose of paraldehyde is given, the patient becomes drowsy and soon falls asleep. The sleep resembles the natural sleep, and lasts from about 5 to 6 hours, but it is not as deep as after chloral. The pulse and breathing are normal, and there are usually no after effects when the patient awakes.

ACTION

The action of paraldehyde is similar to that of chloral.

Local action: Applied to the skin, it causes redness, pain, and occasionally forms blisters. **On mucous membranes:** It causes redness and increases the secretions.

Internal Action

In the mouth: Paraldehyde has a hot, burning taste.

In the stomach and intestines: It increases the secretions; it often causes nausea and occasionally vomiting.

Action after Absorption

Paraldehyde is absorbed into the blood in a few minutes,

through the mucous membrane of the stomach. After absorption, it acts principally on the nervous system.

Action on the brain: Paraldehyde lessens all the activities of the brain. It lessens the appreciation of all sensory impulses, thereby **producing sleep.** Intense sensations, such as pain, can still be appreciated, however, and these may keep the patient awake.

The motor activities of the brain are also lessened, and the muscles are relaxed during sleep.

Action on the spinal cord: Paraldehyde lessens all the activities of the spinal cord. All reflex action is lessened, so that the patient does not respond readily to external stimuli.

Action on the heart and respiration: Paraldehyde does not affect the heart action, and in the doses that it is usually given, it does not affect the breathing.

Effect on the temperature: Paraldehyde lowers the temperature by lessening the production of heat.

Excretion

Paraldehyde is excreted in the urine in a few hours. It is also eliminated by the expired air of the lungs. The breath often has the unpleasant odor of paraldehyde for a long time after it is given.

Poisonous Effects

Paraldehyde rarely, if ever, causes fatal symptoms. Overdoses often cause the following symptoms:

1. Vomiting.
2. Stupor.
3. Slow, shallow breathing.
4. Cyanosis.

If given continually, it occasionally causes:

1. Nausea, loss of appetite, and poor digestion.
2. Ulcers in the nose.
3. Various eruptions, principally areas of redness. (Erythema.)

Uses

Paraldehyde is used principally to produce sleep, and to lessen muscular activity in epilepsy and delirium tremens.

Administration

In giving paraldehyde, it is important to disguise its taste, otherwise many patients cannot take it. It should be well diluted in water or brandy, or it may be given in syrup. It should be given a few minutes before bedtime.

Paraldehyde is frequently given by the rectum, especially in cases of delirium tremens.

Preparations

Paraldehyde (Paraldehydum)	1.0–4.0 gms.	grs. xv–℥ i

SULPHONAL

Sulphonal or sulphonmethanum, is a white powder having no odor or taste. It does not dissolve readily in water. Chemically, it is a compound of sulphur and alcohol.

Appearance of the Patient

Within 1 to 6 hours after giving a dose of sulphonal, the patient falls asleep. The sleep is not very deep, but it lasts from about 8 to 10 hours, and sometimes longer. The pulse and breathing are usually not affected. On awakening, the patient often feels drowsy, complains of fullness in the head, and headache, and his gait may be a little unsteady. Occasionally, sulphonal is so slowly absorbed that it produces sleep the day following its administration.

ACTION

Sulphonal resembles chloral in its effects, which come on much slower, however. Sulphonal produces no local effects.

Internal Action

No effects are produced by sulphonal in the mouth, stomach, or intestines.

Action after Absorption

Sulphonal is very slowly absorbed into the blood from the stomach, usually in about 1 to 6 hours. After absorption, it affects principally the brain.

Action on the brain: It lessens the activity of the brain, producing sleep.

Action on the respiration: In large doses, sulphonal often makes the breathing slow and shallow.

It does not affect the heart action.

Excretion

Sulphonal is eliminated very slowly by the urine, as ethylsulphonic acid. Since it is excreted more slowly than it is absorbed, it often causes cumulative symptoms.

Idiosyncrasies

In some individuals, instead of sleep, the following symptoms are produced.

1. Nausea and vomiting.
2. Excitement.
3. Dizziness.
4. Staggering.

Poisonous Effects

Acute Sulphonal Poisoning

An overdose of sulphonal is rarely, if ever, fatal. It occasionally causes the following symptoms:

1. Stupor.
2. Slow, shallow breathing.

Cumulative Symptoms or Chronic Sulphonal Poisoning

Since sulphonal is more slowly excreted than it is absorbed, its prolonged use often causes the following alarming symptoms, which may even result in death.

1. Pink color of the urine, due to haematoporphyrin, a substance which is formed in the urine by the decomposition of the haemoglobin of the blood.
2. Abdominal pain.
3. Nausea and vomiting.
4. Constipation.
5. Weakness and unsteady gait.
6. Paralysis of various groups of muscles of the arms or legs.

7. Suppressed urine; the urine often containing albumin.
8. Collapse, which may result in death.

Treatment

1. Stop the drug.
2. Give saline diuretics.
3. Move the bowels thoroughly.
4. Treat the collapse with heart stimulants.

Administration

Sulphonal is best given in milk or hot water several hours before bedtime. When given in this way, it acts more readily and is not so apt to cause unpleasant after effects. It is also given in the form of a powder.

Preparations

Sulphonal (Sulphonmethanum)	1.0–2.0 gm.	**grs. xv–xxx**

TRIONAL

Trional, or sulphonethylmethanum, is a powder having a bitter taste. It is an artificial chemical substance.

Appearance of the Patient

An average dose of trional usually produces natural sleep in about 15 minutes to an hour after it is given. The sleep lasts several hours and is accompanied by slight headache.

ACTION

The effects of trional are the same as those of sulphonal. It is more readily absorbed, however, and it does not affect the heart or respiration. It occasionally causes the same chronic poisonous symptoms as sulphonal.

Administration

Trional should be given about a half to one hour before bedtime in large quantities, with hot milk or beer.

Preparations

Trional (Sulphonethylmethanum)	1.0–2.0 gms.	grs. xv–xxx

TETRONAL (not official)

Tetronal is a white powder. Its effects are similar to those of trional and sulphonal. It is given in the same way, but it is not often used because it is more poisonous.

Tetronal	1.0–2.0 gms.	grs. xv–xxx

URETHANE (ETHYL CARBAMATE)

Urethane or ethyl carbamate is a colorless, crystalline powder with a salty taste. It is an artificial chemical substance.

ACTION

Urethane produces sleep in about 15 to 20 minutes, the sleep lasting for about 6 to 8 hours.

Its effects are similar to those of paraldehyde, but it is not as reliable.

It does not upset the stomach, however, and because it is readily dissolved, it may be given hypodermically.

Preparations

Urethane (Aethylis Carbamas)	1.0–4.0 gms.	grs. xv–ʒ i

BROMOFORM

Bromoform is a heavy colorless liquid with an odor and taste like that of chloroform.

ACTION

Bromoform acts like chloral, but its effects appear much slower. Its principal effects are:

1. It produces sleep.
2. It relieves pain.
3. It lessens spasmodic contractions of the muscles.
4. It is an antiseptic.

It is principally used to relieve the spasmodic cough of whooping cough.

Bromoform	0.2 c.c.	m. iii

AMYLENE HYDRATE (not official)

Amylene hydrate is a colorless liquid, having an odor resembling that of camphor, and a pungent taste.

ACTION

It produces sleep; its effects are similar to those of chloral. They are not as marked. It weakens the contractions of the heart and lessens all muscular contractions.

It is best given in capsules or in water, flavored with licorice.

Preparations

Amylene Hydrate (Amyleni Hydras)	2.0–4.0 c.c.	m. xxx–ʒi

HYPNONE (not official)

Hypnone is a colorless liquid formed from alcohol. It has a characteristic odor like that of oranges. It produces sleep but it is not very efficient.

Hypnone	0.3–0.6 c.c.	m. v–xv

NEW AND NON-OFFICIAL HYPNOTICS

VERONAL

Veronal, or diethyl barbituric acid, is a white crystalline powder, which has a slightly bitter taste. It is an artificial chemical substance.

Appearance of the Patient

About fifteen minutes to a half an hour after an average dose of veronal is given, the patient usually falls asleep. The sleep resembles the normal sleep, and lasts for five to six hours. On awakening, the patient often complains of headache and dizziness. Occasionally, some patients have peculiar vivid dreams during the sleep. The pulse

and breathing are not usually affected by veronal. It is a very safe drug.

Administration

Veronal is usually given in hot milk, about fifteen minutes to a half an hour before bedtime.

Preparations

Veronal 0.3–1.0 gm. grs. v–xv
(Veronalum)
Diethyl Barbituric Acid

It usually comes in tablets each containing 0.3 gm. (grs. v) each.

Veronal Sodium 0.3 gm. grs. v
(Sodium Diethyl Barbiturate)

This is a sodium salt of veronal. It usually comes in tablets each containing 0.3 gm. (grs. v). It produces the same effects as veronal, but since it is more readily dissolved, it produces sleep more rapidly, and it can be given hypodermically or by rectum.

Medinal 0.3 gm. grs. v

This is a proprietary name for sodium veronal. It usually comes in tablets.

Medinal Suppositories

Each suppository contains 0.5 gm. (grs. vii½).

CHLORETONE

Chloretone is a white crystalline powder which has an odor like camphor and does not readily dissolve in water.

ACTION

Local action: Applied to the skin, it acts as an antiseptic.

Internal Action

When it is taken internally, it soothes the stomach, and is rapidly absorbed into the blood by the mucous membrane.

After absorption, it acts principally on the brain. It lessens the activity of the brain, producing sleep. It also lessens the motor activities of the brain, so that fewer impulses for motion are sent out from the brain, and it lessens muscular contractions. It can produce general anaesthesia, but it is rarely used for this effect.

Uses

Chloretone is used to produce sleep, and very frequently to check an epileptic attack, and to lessen other convulsions such as those occurring in tetanus, etc. It is occasionally used to check vomiting and seasickness.

Preparations

Chloretone	0.3–1.0 gm.	grs. v–xv

It is also used in a 1% solution.

HEDONAL

Hedonal is a white crystalline powder with a cooling taste, like that of menthol.

It produces sleep in about half an hour after it is given. It is a safe drug and produces no after effects. It occasionally increases the flow of urine.

Preparations

Hedonal	2.0 gms.	grs. xxx

It is given in powder or in tablets.

ISOPRAL

Isopral is a white crystalline substance, with an aromatic taste and an odor resembling camphor.

It produces sleep in about five minutes after it is given. Its effects are similar to those of chloral, but it is not as poisonous. It is said to be absorbed through the skin.

Preparations

Isopral	0.2–0.5 gm.	grs. iii–viii

NEURONAL

Neuronal is a white crystalline substance having a bitter taste and odor resembling menthol. It produces sleep. Its effects resemble those of veronal, and it is given in the same way.

Neuronal	0.3–2.0 gms.	grs. v–xxx

DORMIOL (AMYLENE CHLORAL)

Dormiol or amylene chloral, is a colorless oily fluid with an odor like that of camphor. It is a compound of amylene hydrate and chloral. It produces sleep in about half an hour after it is given, with no after effects and it does not weaken the heart action. It is given principally to insane patients.

Preparations

Amylene Chloral	1.0–4.0 c.c.	m. xv–ʒi
Acetal	4.0–8.0 gm.	ʒi–ii

Methylal

These are chemical substances formed from alcohol, which are occasionally used to soothe the patient and to produce sleep. They act like sulphonal.

PELLOTINE HYDROCHLORIDE 0.015–0.6 gm. grs. ¼–i

This is an alkaloid from a Mexican plant used to produce sleep.

MORPHINE AND OPIUM

Morphine and opium produce sleep when the patient is unable to sleep on account of pain. Their effects will be more fully described under their more important actions.

BROMIDES

Bromides produce sleep when the patient is unable to sleep on account of nervousness.

TABLE OF COMPARATIVE ACTION OF HYPNOTICS

Name of Drug	Action on Stomach	Rate of Absorption	Action on the Heart	Action on the Respiration	After Effects	Poisonous Symptoms
Chloral.	Occasional nausea.	Rapid.	Slow and weak.	Slow and shallow.	Occasional headache and dizziness.	Weak heart action. Sudden heart failure.
Chloralamid.	Same.	Same.	Not as weak.	Not so slow.	Same.	Safer than chloral.
Paraldehyde.	Very unpleasant taste.	Same.	No effect.	No effect.	No after effects.	Not poisonous.
Sulphonal.	No effect.	Very slow.	Same.	Same.	Headache, drowsiness. Fullness in the head.	Cumulative effects.
Trional.	Same.	Slow.	Same.	Same.	Slight headache.	Not poisonous.
Veronal.	Same.	Moderately rapid.	Same.	Same.	Slight headache, occasional dreams.	Not poisonous.
Medinal (can be given hypodermically).	Same.	Rapid.	Same.	Same.	Same.	Same.
Chloretone (it lessens muscular contractions).	Soothing.	Rapid.	Same.	Same.	No after effects.	Same.
Urethane (can be given hypodermically).	Same.	Same.	Same.	Same.	Same.	Same.
Amylene Hydrate.	Occasional nausea.	Moderately rapid.	Slow and weak.	Slow and shallow.	Same.	Same.
Hedonal (diuretic).	No effect.	Same.	No effect.	No effect.	Same.	No effect.
Isopral.	Same.	Same.	Same.	Same.	Same.	Same.
Neuronal.	Same.	Same.	Same.	Same.	Same.	Same.
Dormiol used on insane patients.	Same.	Same.	Same.	Same.	Same.	Same.

ANODYNES

Anodynes are drugs which are used principally to relieve pain. Pain can be relieved in several ways.

1. By lessening the activity of the sensory areas of the brain so that the impulses of pain which the brain receives, are not appreciated.
2. By lessening the activity of the nerve endings in the skin which receive the impulses of pain.

Anodynes are divided into two classes:

1. **General Anodynes**
2. **Local Anodynes**

General anodynes relieve pain when given internally.

Local anodynes relieve pain when applied only to the particular tissue where the pain is felt.

Only the general anodynes will be considered here. The most important drug of this group is opium, and its alkaloid morphine. The local anodynes will be considered under their appropriate local effects.

OPIUM AND MORPHINE

Opium is the hardened dried juice of the unripe capsules of the **Papaver somniferum** or white poppy, a plant which grows principally in Turkey, Asia Minor, Persia, India and China. The drug is obtained by making a longitudinal cut in the side of the capsule, when a thick white milky juice oozes out. This is exposed to the air, and allowed to dry. It then turns brown and hard, and is wrapped up in the leaves of the plant. This dried juice with a peculiar characteristic odor is the crude opium, from which all the preparations are made.

Opium is one of the oldest drugs in medicine. It is the most reliable and most useful drug in our entire Materia Medica. It relieves better than anything else, the suffering and pain caused by any disease.

Active Principles

Opium produces its effects by means of a large number of active principles which it contains. They are all alkaloids. The most important of these are:

Morphine
Papaverine
Codeine
Narcotine
Thebaine

The action of opium is due principally to the **morphine** which it contains, usually amounting to 9% of the drug. Morphine affects principally the brain, while the other alkaloids each successively affects the brain less, and the medulla and spinal cord more, so that thebaine produces effects similar to that of strychnine, which are due principally to the action on the spinal cord, and very little to its action on the brain.

Appearance of the Patient

About ten to fifteen minutes after giving an average dose of opium or morphine, the patient complains less of the pain from which he may have been suffering. He becomes calm and quiet, and feels comfortable. He usually lies in a quiet dreamy state, his mind filled with vivid images and brilliant ideas. When spoken to, he does not pay attention, because his mind is preoccupied with continual vivid dreams, in which the patient seems to see various objects and persons about him, and he seems to be in various places. These dreams cause so much pleasure, that the patient forgets; everything—pain, cares, worries, even the idea of time seems to be shortened for him.

Soon however, the patient falls into a light sleep from which he can be easily aroused. During the sleep, he usually has vivid dreams, many of which he often remembers afterwards. Often the sleep resembles the natural sleep. The breathing is slow and shallow, the pulse is perhaps somewhat slower, the face is flushed, the pupils are contracted and the skin may be moist. These effects last for several hours, and gradually wear off, leaving the patient feeling

dull and depressed, with dryness of the throat and occasionally a slight headache and nausea.

ACTION

Local action: Applied to the unbroken skin, opium slightly relieves pain by paralyzing the sensory nerve endings. **On wounded surfaces or ulcers:** It contracts and hardens the tissues (astringent action).

Mucous membranes are contracted, and their secretions checked by opium. Opium is readily absorbed from wounded surfaces and mucous membranes when locally applied to them.

Internal Action

In the mouth: It checks the secretions and contracts the mucous membrane, causing a feeling of dryness.

In the stomach: It checks the secretion of gastric juice and lessens the peristalsis. The food is therefore more slowly digested. It also lessens the appetite and the feeling of hunger. Later, however, opium or morphine increases the secretions in the stomach and may even cause nausea and vomiting.

In the intestines: The secretions of the mucous membrane and the peristaltic contractions of its muscle wall are lessened. Constipation then results.

Action after Absorption

Opium or morphine is very slowly absorbed into the blood through the mucous membrane of the stomach, usually in about ten to fifteen minutes. When given hypodermically, it is absorbed in about two to five minutes. After absorption, it affects principally the brain, the respiration, the secretory glands and the pupil.

Action on the Nervous System

On the brain: Opium or morphine lessens all the activities of the brain except the imagination, which is made more active.

On the sensory areas: It lessens the activities of all the sensory areas of the brain. Thus, the appreciation of all

sensory impulses, especially that of **pain, is lessened.** Since consciousness is the result of the sensory impressions received through our sensations, by lessening these, opium or morphine **produces unconsciousness or sleep.** When the patient is unable to sleep on account of pain, these drugs are particularly valuable. The sleep is light, however, and the patient may be easily awakened. Often it is deeper and resembles the natural sleep.

On the motor areas: The action of the motor areas of the brain is slightly lessened, so that the patient is not quite so active.

On the mental activities: The higher mental activities of the brain, such as will power, judgment, reasoning, and concentration are all lessened, so that the intelligence is lessened.

The action of the imaginative center of the brain, however, is greatly increased. The patient is then able to combine all old impressions that have been stored up in the brain, more readily and more rapidly into new ones. The resulting thoughts then flow more freely.

Vivid dreams therefore occur continually, during the sleep of opium or morphine. Even when the patient is awake, but under the influence of the drug, he may be absorbed in various thoughts and dreams which he may conjure up before his mind. These give the patient a feeling of pleasure and comfort, and absorb his thoughts so that he forgets everything—pain, worries, cares, even the idea of time. It is because of these pleasant effects, that opium tends to form a habit, if given continually. The patient may even have brilliant ideas under the effect of this drug, but because of the lessened will power which it produces, he is unable to carry these ideas into effect.

The increased activity of the imagination is more marked in more educated, and higher intellectual types of individuals. Some of the best literary works in the world have been written while the author was under the influence of opium, when his imagination was very active.

Action on the respiration: Opium or morphine makes the breathing slower and shallower by lessening the impulses for

breathing, that are sent out from the respiratory center in the medulla.

Action on the circulation: It produces no effect on the heart.

The blood vessels of the face and neck are widened, however, causing a flushed face and a feeling of warmth.

The pulse after opium or morphine, is usually a normal strong pulse. With larger doses, the pulse is somewhat slower but stronger.

This is due to the slow breathing which prevents the blood from getting the proper amount of oxygen, and the character of the pulse is the result of the slight asphyxia which then occurs.

Action on the secretory glands: Opium or morphine checks all the secretions except the sweat, which it increases.

The flow of saliva, of bile, of the secretions of the mucous membranes of the stomach and intestines are all lessened. The secretion of urine is often markedly diminished.

The perspiration is increased more by the preparations of opium than by those of morphine.

Action on the involuntary muscles: The contractions of the involuntary muscles are lessened. Intestinal peristalsis is thus lessened, which, in addition to the checked secretion of the intestines, causes constipation.

Action on the pupil: Opium or morphine contracts the pupil. It makes the pupil very small when given internally. When applied locally to the conjunctiva it produces no effects.

Excretion

Opium or morphine, is rapidly eliminated from the body mainly by the digestive tract; into the stomach, intestines and saliva, usually in about an hour. The excretion of the drug into the stomach often increases its secretions, and causes nausea and vomiting. Often the drug is absorbed again from the stomach. It is also slightly excreted by the urine.

Summary of Effects

The most important effects of opium or morphine are the following:

1. It relieves pain.
2. It makes the breathing slower.
3. It lessens all the secretions, except the sweat; which is increased.
4. It checks peristalsis, producing constipation.
5. It contracts the pupil.

Idiosyncrasies

a. Idiosyncrasies of Effect.

In some individuals, the following unusual effects occasionally occur:

1. Weakness and depression.
2. Continual nausea and vomiting.
3. Delirium and excitement.
4. Convulsions.
5. Redness of the skin and itching while the effects are passing off.
6. Absence of urinary secretion, especially in cases of nephritis.

b. Idiosyncrasies of Dose

In some individuals a very small dose may cause very deep sleep, and even poisonous effects. In others, a very large dose may cause no effects at all, or only slight effects. Old people and children are very susceptible to opium or morphine. They may get poisonous symptoms from very small quantities.

Poisonous Effects

Poisoning from opium or morphine occurs in two forms, acute opium poisoning and chronic opium poisoning or opium habit.

Acute Opium Poisoning

Acute opium poisoning usually results from an overdose given medicinally, or taken with suicidal intent.

Symptoms

Since the most striking effect of opium is sleep, the symptoms are divided into three stages, depending on whether

the patient **can be aroused** from the sleep, whether he **can be aroused with difficulty** (stupor) or whether **he cannot be aroused at all (coma).**

Symptoms of the First Stage

1. **Very deep sleep,** from which the patient can be aroused, but soon falls asleep again.
2. **Slow, shallow breathing.**
3. Slow, strong pulse.
4. Flushed face.
5. **Contracted pupils.**
6. Profuse perspiration.

If a very large dose has been taken, these symptoms may last for a very short time, or they may be absent entirely, and are soon followed by

The Second Stage or Stage of Stupor

1. **The sleep is very deep,** and the patient can be aroused only with great difficulty. If spoken to in a loud voice, or when he is shaken and his attention attracted, he may remain awake for a few minutes; but he soon falls asleep again.
2. **The breathing is very slow and shallow,** about 8 to 10 times a minute. It often becomes periodic; a few moments of breathing alternating with periods of absent breathing (Cheyne Stoke's Respiration).
3. The pulse is slow and strong.
4. **The pupils are contracted and are very small.**
5. The face is pale or it may be blue; because the blood does not get enough oxygen on account of the slow and shallow breathing.
6. The skin is covered with perspiration.

These symptoms last for a short time, and the patient soon passes into

The Third Stage or Stage of Coma

1. **The patient now lies in a very deep sleep, from which he cannot be aroused.**

2. **The breathing is very slow and shallow, about 3 to 4 times a minute.**

3. The pulse is rapid and weak.

4. **The face is blue in color (cyanosis).**

5. The pupils are very small, so that they can hardly be seen. They are often called "**pin-point pupils,**" because of their extremely small size.

6. Skin is cold and moist.

The breathing finally becomes still slower, the pupils dilate, and the patient dies from paralysis of the respiration, though the heart may beat for several minutes afterwards.

Synopsis of Poisonous Effects

The characteristic symptoms of acute opium or morphine poisoning are:

1. Very deep sleep, stupor, followed by coma.
2. Slow and shallow breathing.
3. Slow pulse.
4. Contracted pupils "pin-point pupils."
5. Cyanosis.
6. Profuse perspiration.

Treatment

1. Wash out the stomach, with plain water, or better still, with a 1–5000 potassium permanganate solution. This destroys the drug. The washing should be repeated every half hour until the patient is entirely out of danger. Even if the drug is given hypodermically, the stomach should be washed out, as the drug is excreted into the stomach, and repeated washings help to get rid of it.

2. If the stomach cannot be washed out, for lack of apparatus, etc., or if a solid preparation has been taken, emetics should be given repeatedly, about every 15 minutes.

A tablespoonful of mustard in a glass of water, zinc sulphate 0.6–2.0 gms. (grs. x–xxx) or copper sulphate 0.3–0.6 gm. (grs. v–x) may be given to produce vomiting.

Give also potassium permanganate to destroy the drug.

3. **Give atropine,** gr. $\frac{1}{100}$. This is the antidote for morphine. It should be repeated every 15 minutes or half

hour until the breathing becomes deep and fast. Atropine should never be given without the doctor's orders, as atropine poisoning may result from its injudicious use, and more harm done.

4. Keep the patient awake by applying cold douches on the skin, by rubbing or striking him with cold towels. This increases the breathing and keeps the patient awake; and, while the patient is awake, the breathing is increased. Care must be taken, however, not to exhaust the patient by too violent measures.

5. Keep up artificial respiration continuously.

6. Give respiratory stimulants, such as caffeine, or a hot coffee enema, strychnine, etc.

7. Apply the farradic current to the Vagus nerve in the neck.

8. Keep the patient warm.

9. Catheterize the bladder.

Artificial respiration may also be given by a new method, by means of pumping air into the lungs through a catheter inserted into the trachea. The air is pumped into the lungs by means of a specially constructed apparatus used for giving anaesthesia in this way. (Meltzer Auer method.)

The treatment of opium poisoning should be kept up for hours, as long as the patient is alive. Patients have recovered from as much as 2.0 gms. (grs. xxx) of morphine, by persistent treatment.

Chronic Opium Poisoning or Opium Habit

The opium habit results occasionally in patients to whom it has been necessary to give opium or morphine for a long period of time. The pleasant effects which opium causes, often induce the habit. It is usually taken in the form of opium pills, laudanum, or by hypodermic injections of morphine. In China and India, the crude opium is smoked by many people. Opium habitués may take as much as 300 grs. of opium without causing dangerous symptoms.

Symptoms

The patient usually has a great craving for the drug, princi-

pally because it helps him to forget everything—cares, worries, troubles, even the idea of time. He looks dull and dreamy, his mind is occupied with various images and ideas, and he has absolutely **no will power.** He lacks all sense of honor and truth. The untruthfulness of the opium habitué is proverbial. Thus, pills of opium, or a hypodermic syringe and morphine tablets may be found under his pillow, and yet he will deny all knowledge of them.

The patient is **very nervous,** he has **no energy** and he can do no work, except when he is under the influence of the drug. His gait is unsteady, he has **tremors of the muscles,** he is very **anaemic** and loses weight. The pulse is often irregular and the **pupils are contracted.** He has no appetite, his bowels are constipated, though there are periods when he has profuse diarrhoea.

The patients often have abscesses on the extremities, from lack of care in taking hypodermic injections.

In some patients, melancholia and various forms of insanity occur from continued use of the drug. In others, no serious results may follow.

If the drug is suddenly stopped, the most intense misery is produced, and the patients are in a most pitiable state, for want of the drug.

An average dose of opium or morphine usually does not produce sleep in opium habitués.

Treatment

The opium habit is best treated in special sanatoria for that purpose. The drug should be stopped gradually, and the patients should be very carefully watched, as they will use the most ingenious methods to obtain the drug through their friends, through the mails, etc.

Uses

Opium or morphine is used for a great many conditions. In fact, there is hardly a condition or disease in which this drug is not useful. It is used principally:

1. To relieve pain. For this purpose it is the best and most reliable drug in our entire Materia Medica.

2. To produce sleep, especially when the patient is unable to sleep on account of pain.

3. To lessen peristalsis and produce constipation.

4. To check the secretions, except the sweat.

5. To lessen all forms of nervous excitement, such as delirium tremens, convulsions, tetanus, etc.

Administration

For rapid effects, morphine, given hypodermically, is the best preparation to use. Opium is better where constipation is desired.

Preparations

Opium

Solid Preparations

Powdered Opium (Opii Pulvis) 0.03–0.12 gm. grs. ½–ii

This contains 12% of morphine.

Deodorized Opium (Opii Deodoratum) 0.03–0.12 gm. grs. ½–ii

This contains 12% of morphine, but its odorous substances have been removed.

Pills of Opium (Pilulae Opii) 1 pill

Each pill contains 0.06 gm. (gr. i) of powdered opium. These pills must be freshly made, as otherwise they accumulate in the stomach and cause poisonous effects.

Extract of Opium (Extractum Opii) 0.015–0.06 gm. gr. ¼–i

This contains 20% of morphine.

Powder of Ipecac and Opium (Pulvis Ipecacuanhae et Opii) (Dover's powder) 0.6 gm. grs. x

Each powder contains 0.06 gm. (gr. i) each of ipecac and opium, and 0. 5 gm. (grs. viii) of milk sugar (it contains 10% of opium). Dover's powder is taken at night in hot

lemonade to break up a cold. It increases the perspiration very freely.

Troches of Licorice and Opium
(Trochisci Glycyrrhizae et Opii)
(Wistar's cough lozenges)

Each lozenge contains gr. ½ of opium. It is used to lessen cough.

For Local Use

Opium Plaster
(Emplastrum Opii)

This contains 6% of opium.

Liquid Preparations

Tincture of Opium 0.3–1.0 c.c. m. v–xv
(Tinctura Opii)
(Laudanum)

This contains 10% of opium.

Tincture of Deodorized Opium 0.3–1.0 c.c. m. v–xv
(Tinctura Opii Deodorata)
(McMunn's elixir)

This contains 10% of opium. It contains no narcotine, and no odorous principals, and is therefore more pleasant to take.

Camphorated Tincture of Opium
(Tinctura Opii Camphorata)

(Paregoric)

For Adult

4.0–16.0 c.c. ʒi–iv

For Children

Under 1 year	0.06–0.3 c.c.	m.	i–v
" 2 years	0.3 –1.0 c.c.	m.	v–xv
" 3 "	0.3 –1.3 c.c.	m.	v–xx
" 5 "	0.3 –1.6 c.c.	m.	v–xxv
" 10 "	1.0 –2.0 c.c.	m.	xv–xxx

Paregoric contains 0.12 gm. (grs. ii) of opium to 30.0 gms. or (ʒ i) together with camphor, benzoic acid, oil of anise and glycerine. It is the best preparation of opium to use for children.

Tincture of Ipecac and Opium 0.3–1.0 c.c. **m. v–xv**
(Tinctura Ipecacuanhae et Opii)
(Tincture of Dover's powder)

This contains 10% of opium.

Wine of Opium 0.3–1.0 c.c. m. v–xv
(Vinum Opii)

This is flavored with cinnamon and cloves.

Acetum Opii 0.3–1.0 c.c. m. v–xv
(Black drop)

This is opium extract with dilute acetic acid.

Mistura Glycyrrhizae Composita 15.0–30.0 c.c. ʒ ½–i
(Brown's mixture)

This contains 1 part of opium in 1000 of the mixture. It consists of paregoric, licorice, wine of antimony, and spirits of nitrous ether. It is used to lessen cough.

Compound Tincture of Opium 4.0 c.c. ʒ i
(Tinctura Opii Composita)
(Squibb's diarrhoea mixture)

This contains tincture of opium, tincture of capsicum, spirits of camphor, chloroform and alcohol.

ALKALOIDS OF OPIUM

Morphine

The effects of opium are due principally to the morphine which it contains.

The effects of morphine differ slightly from those of opium in the following ways:

1. Morphine is much more rapidly absorbed, and therefore acts more rapidly.
2. It can be given hypodermically.
3. It does not increase the secretion of sweat as much as opium.
4. It is not as constipating as opium.

Preparations

Morphine 0.008–0.03 gm. gr. ⅛–½
(Morphina)

Morphine Sulphate (Morphinae Sulphas)	0.008–0.03 gm.	gr. $\frac{1}{8}$–$\frac{1}{2}$
Morphine Hydrochloride (Morphinae Hydrochloridum)	0.008–0.03 gm.	gr. $\frac{1}{8}$–$\frac{1}{2}$
Compound Morphine Powder (Pulvis Morphinae Compositus) (Tully's powder)	0.3 –1.0 gm.	grs. v–xv

This contains morphine sulphate, licorice powder, and camphor.

Magendie's solution of morphine (not official).

This is a 1 to 30 solution of morphine sulphate (or grs. xvi to the ounce). This is a solution which is very commonly used for hypodermic administration. It should always be fresh, as a fungus often grows in old solutions, and makes it unfit for use, or it may change the morphine to apomorphine.

Morphine Meconate (Morphinae Meconas)	0.008–0.03 gm.	gr. $\frac{1}{8}$–$\frac{1}{2}$

Codeine

Codeine, one of the active alkaloids of opium, is a compound of morphine (methylmorphine). Its effects are similar to those of morphine, with the following differences:

1. It does not produce sleep as readily as morphine, and the sleep is very light.
2. It does not slow the breathing as much as morphine, and is therefore safer.
3. It does not produce constipation.
4. It is not so apt to induce the habit.

Preparations

Codeine (Codeina)	0.015–0.06 gm.	gr. $\frac{1}{4}$–i
Codeine Sulphate (Codeina Sulphas)	0.015–0.06 gm.	gr. $\frac{1}{4}$–i
Codeine Phosphate (Codeina Phosphas)	0.015–0.06 gm.	gr. $\frac{1}{4}$–i
Eucodin (Methyl Codeine Bromide)	0.06 gm.	gr. i

This is used like codeine, as a sedative for cough, but it is said to increase the secretion of mucus.

Narcotine causes muscular twitchings, and **thebaine** acts like strychnine, causing convulsions. Both of these alkaloids are not used in medicine.

Artificial Alkaloids of Morphine

The following alkaloids are made artificially, by the action of various chemical substances on morphine.

Dionin

Dionin is an artificial alkaloid made from morphine (ethyl morphine).

Its effects are similar to those of codeine. It is safer than morphine, and it does not induce a habit. It is used to produce sleep and relieve pain.

Preparations

Dionin (Dionina)	0.015–0.06 gm. gr. $\frac{1}{4}$–i

Peronine

Peronine is a substance which has the same effects as dionin. It is given in the same doses.

Heroin

Heroin is an artificial alkaloid made from morphine by its combination with an organic salt of acetic acid (diacetyl morphine hydrochloride). Its effects are similar to those of morphine with the following differences.

1. It slows the breathing more.
2. It does not produce sleep as easily.
3. It does not induce a habit.

It is used principally to lessen coughing.

Preparations

Heroin (Heroina)	0.0025–0.01 gm. gr. $\frac{1}{24}$–$\frac{1}{6}$
Heroin Hydrochloride (Heroinae Hydrochloridum)	0.0025–0.01 gm. gr. $\frac{1}{24}$–$\frac{1}{6}$

There are several other drugs which contain alkaloids in very small amounts, which act like morphine. The most important of these are:

Sanguinaria Canadensis or Blood Root
Chelidonium Majus or Celandine

Lactucarium

Lactucarium is the dried, milky juice obtained from the **Lactuca virosa,** or garden lettuce. It is occasionally used as a substitute for opium, to relieve pain and produce sleep. It is given in the form of a tincture, in doses of 0.6–4.0 gms. (m. x–3 i) or in the form of a syrup.

CANNABIS INDICA (INDIAN HEMP)

Cannabis indica is a resinous substance obtained from the flowers of the **Cannabis sativa** or Indian hemp, a plant growing in India, Egypt, and the southern part of the United States.

It is used as an intoxicant in most of the Eastern countries in various forms. In India, the dried plant is used for smoking, either alone or with tobacco, and is called **gunjah** or **bhang. Churrhus** or **hashish** is an intoxicating drink containing the resinous juice, which is used in Arabia and Egypt. The resinous substance is also often flavored with sugar or honey, and made into a confection. The active principle of cannabis indica is said to be a red oil or resin called **cannabinol.**

Appearance of the Patient

About a half to one hour after giving an average dose of a reliable preparation of cannabis indica, the patient feels drowsy, the sense of pain is lessened, the extremities feel numb, the patient often complains of noises in the ear, and he soon falls into a deep sleep, lasting several hours, from which he usually awakes refreshed. During the sleep, he may have particularly vivid beautiful dreams. The pulse and breathing are normal and the pupils are dilated. Occasionally the patient may be somewhat exhilarated before falling asleep.

ACTION

Cannabis indica produces no local effects.

Internal Action

When given internally it has a peculiar taste, it produces no effect in the stomach and the intestines, but is rapidly absorbed into the blood, from the stomach; and it then acts principally on the brain.

Action on the brain: Cannabis indica lessens the appreciation of the various sensations, such as pain, touch, etc. In this way, **it relieves pain and produces sleep.**

The imagination is increased, however, and the patient usually has beautiful vivid dreams, during the sleep. Ideas and thoughts arise so rapidly under the effect of cannabis indica that time seems to be shorter than it really is, because events which otherwise take place over a long period of time, seem to occur in a few moments. The judgment and reasoning powers of the brain, however, are lessened. The pulse and respiration are not usually affected. **It dilates the pupil.** Cannabis indica also increases the sexual desires.

The effects of different preparations seem to vary. The preparations grown in warm climates produce a greater effect than those grown in colder climates. Many preparations produce no effects.

Cannabis indica is not a poisonous drug, though large doses may make the patient feel alarmed of his condition.

Effects of Large Doses

When cannabis indica is taken in large doses, or when it is smoked, it usually produces a characteristic state of pleasure and exhilaration which accounts for its frequent use as an intoxicant.

Very soon after taking a large amount of hashish, the patient goes into a dreamy, drowsy state, during which he has the most beautiful dreams, and forgets everything—cares, worries, troubles, events which occur about him, even the individuals about him. He has visions of the most gorgeously beautiful scenes, amidst which he imagines all

sorts of romantic incidents. He is usually joyful and happy, and seems to be in a garden of paradise far more beautiful than every previous conception of it.

These dreams are more marked in the languid oriental people. Europeans or Americans, unless they are particularly emotional, often do not have such extravagant dreams, but merely become joyful and happy.

During this state of exhilaration, ideas arise so rapidly, that time seems to pass much faster than usual. Events which usually last hours seem to occur in several minutes. Often the individual has a sense of impending death, and many have a dual personality. This state of exhilaration lasts for a short time, perhaps an hour, and the patient then falls into a normal, quiet sleep from which he is readily awakened.

The pulse is perhaps a little stronger and faster, the breathing is normal, and the pupils are dilated.

In India, the natives often produce a state of catalepsy (stiffening of all the muscles) by means of hashish.

Uses

Cannabis indica is used to relieve pain and produce sleep as a substitute for morphine; in neuralgia, painful menstruation, chorea, hysteria, etc. It is an unreliable drug, however, as many of its preparations are inactive.

Preparations

Extract of Cannabis Indica (Extractum Cannabis Indicae)	0.015–0.06 gm.	gr. ¼–i
Fluidextract of Cannabis Indica (Fluidextractum Cannabis Indicae)	0.1 –0.3 c.c.	m. ii–v
Tincture of Cannabis Indica (Tinctura Cannabis Indicae)	1.0 –2.0 c.c.	m. xv–xxx

Other Anodynes

For other drugs which relieve pain see **belladonna group,** page 247.

Local Anodynes

For drugs which relieve pain when applied locally, see **local anaesthetics,** page 398.

ANTIPYRETICS

Antipyretics are drugs which are used principally to lower the body temperature.

The Temperature of the Body

The heat of the body is produced by the activity of the cells of the various organs of the body and by the contractions of the muscles.

When too much heat is produced, the excessive amount of heat is eliminated in the following ways:

1. **By evaporation from the skin.** The widened blood vessels of the skin contain more overheated blood, and the excessive heat evaporates from the skin.

2. **By increased perspiration.** The perspiration is overheated, and the profuse perspiration eliminates some of the heat.

3. **By the exhaled air.** The expired air contains more heat; which is then eliminated.

The heat of the body is kept at a constant temperature, usually about 98.6 Fahrenheit, by means of a regulating center of gray matter in the brain (situated in the region of the corpora quadrigemina). This is called the heat regulating center. This center keeps the body temperature always at 98.6 F. in the following ways.

1. **When the temperature is below 98.6 F.,** it is brought up to normal again by increased production of heat, by means of increased muscular activity, and greater activity of the various organs of the body. For example, after a convulsion or a chill, which are series of muscular contractions, the temperature usually rises several degrees.

2. **When the temperature is above 98.6 F.,** the temperature is lowered to normal again, by the increased elimination of heat; which is produced by increased sweating, by dilatation of the blood vessels of the skin, and by deeper and faster breathing. For example, when the weather is warm and not enough heat is lost, the temperature is kept normal by profuse sweating, flushed skin, and deeper breathing.

In cold weather, if we are not sufficiently clothed, and we are therefore constantly losing heat, more heat is immediately produced by the shivering which results. This is a series of fine muscular contractions or tremors, which produces enough heat to raise the body temperature to normal again.

The sensitiveness of the heat regulating center, varies in different individuals. This sensitiveness can be tested by observing how low the temperature must be reduced, before shivering is produced in a particular individual; or how high the temperature must be raised, before sweating is produced.

Fever

The bacterial poisons which cause most of the infectious diseases, usually affect the heat regulating center in such a way, that it keeps the heat of the body regulated for a temperature higher than normal; perhaps 102 F. or 103 F., etc.

We then have in these infectious diseases, the higher temperature of the body as one of the symptoms of the disease. The usual temperature of that disease may be said to be its normal temperature. If, however, the temperature rises several degrees above the usual, the excessive heat is eliminated by sweating, flushed skin, etc., just as in the normal individual, until the temperature is lowered again to the usual height for that particular disease.

When the temperature is lower than the usual for that particular disease, more heat is produced by shivering, or a chill, until the temperature is raised again to the usual degree.

When, however, the infection is overcome, the heat regulating center is again set for its normal point 98.6 F.

Reduction of Temperature

The temperature can be lowered in three different ways:

1. **By lessening the production of heat.** This is accomplished by such drugs as quinine, morphine, aconite, etc., drugs which lessen the muscular and other activities of the body.

2. **By increasing the elimination of heat.** Drugs like pilo-

carpus or morphine which produce sweating, and drugs which widen the blood vessels of the skin, such as the nitrites, or the spirits of nitrous ether, reduce the temperature in this way.

3. **By setting the heat regulating center for a temperature nearer normal,** so that the excessive heat is eliminated, and less heat is produced. When the temperature is normal, these drugs produce no effect. Most of the antipyretics in common use act in this way.

Source of Antipyretics

The group of drugs which are principally used to lower temperature are made by chemical methods from coal tar. This is a thick tarry liquid which remains as a sediment, together with other substances, after coal has been distilled in the manufacture of illuminating gas.

The effects of these antipyretics are due to **paramidophenol,** and other substances which these drugs form in the body.

ANTIPYRINE

Antipyrine is a white crystalline powder which is readily dissolved in water. It resembles an alkaloid in its chemical properties; combining with acids to form salts.

Appearance of the Patient

About fifteen minutes to a half hour after an average dose of antipyrine is given, the patient is relieved of headache, and nervous pains from which he may have been suffering, and he feels calm and quiet. The face is flushed and the skin is moist and cool. The pulse and breathing are somewhat fast at first, but they soon become slower. If the patient has a high temperature, it may be reduced one or two degrees, and in two or three hours it is reduced to the normal, and perhaps to slightly below normal. The effects of antipyrine last several hours, and then wear off.

ACTION

Local action: Applied to the skin or mucous membranes,

antipyrine relieves pain and acts as an antiseptic. It is said to check bleeding by contracting the small blood vessels.

Internal Action

In the mouth: It has a bitter taste.

In the stomach and intestines: The secretions are increased. It occasionally causes nausea and vomiting in fever patients.

Action after Absorption

Antipyrine is rapidly absorbed into the blood from the stomach, usually in about fifteen to twenty minutes. After absorption it affects principally the brain, the temperature and the heart.

Action on the brain: Antipyrine soothes the action of the brain.

It relieves neuralgic pains and various nervous headaches, making the patient calm and quiet without producing sleep. The mode of this action is unknown. In some patients, or in large doses, it occasionally produces light sleep, possibly by lessening the nervous pains and headaches which prevent sleep.

Action on the spinal cord: Antipyrine increases the action of the spinal cord. The patient then responds more easily to external impulses (increased reflex action).

Action on the temperature: Antipyrine lowers the temperature in fever, about one or two degrees, or even to normal, by setting the heat regulating center for a lower temperature. The temperature may remain down for several hours.

Action on the circulation: The pulse is somewhat faster at first, but it soon becomes slower and sometimes weaker because of the weakened contractions of the heart muscle.

Action on the respiration: The breathing is somewhat more rapid at first, but soon becomes slower.

Action on the secretory glands: Antipyrine increases the perspiration.

Excretion

Antipyrine is slowly eliminated from the body by the kidney, usually in about twelve to twenty-four hours.

Idiosyncrasies

In some individuals, such as those that are anaemic, or those that have been weakened by prolonged illness, the following unusual symptoms occasionally occur.

1. Skin eruptions, redness and itching, often swelling of the face and eyelids, which may last for several days.
2. Nausea and vomiting.
3. Collapse.
4. Dizziness.

Poisonous Effects

The symptoms of poisoning may follow a single overdose of antipyrine, in which case they come on suddenly. Usually however, the symptoms result from taking antipyrine continually in the form of some patent headache powder to relieve headache.

Symptoms

1. **Difficult rapid breathing.**
2. **Slow, weak, irregular pulse.**
3. **Cyanosis:** This is a blue color of the skin which is due to the formation of methaemoglobin in the blood, which is a modified form of haemoglobin unable to take up oxygen from the lungs.
4. Nausea and vomiting.
5. Muscular weakness.
6. Profuse perspiration.
7. Twitching of the muscles.
8. Convulsions.
9. Collapse (weak, thready pulse, slow shallow breathing, and dilated pupils).

Death results from respiratory paralysis, the patient remaining conscious to the last.

Treatment

1. Keep the patient quiet.
2. Wash out the stomach.
3. Give atropine, to improve the breathing and lessen the

perspiration; and strychnine, caffeine and other heart stimulants.

4. Give inhalations of oxygen to relieve the cyanosis.

Administration

Antipyrine is occasionally given hypodermically, and it should then be injected deep into the muscles, to prevent the formation of abscesses.

By mouth, it is best given after meals in a little wine, iced brandy or in syrup. It is usually given together with caffeine to overcome the weakening action on the heart.

Preparations

Antipyrine (Antipyrina)	0.3–1.3 gms.	grs. v–xx
Antipyrine Salicylate (not official) (Antipyrinae Salicylas) (Salipyrin)	0.3–2.0 gms.	grs. v–xxx

This is a combination of antipyrine with salicylic acid. It is said to relieve rheumatic pains more efficiently than either of its constituents alone.

Ferropyrine (not official) (Antipyrina cum Ferro)	0.3–1.0 gm.	grs. v–xv

This is a compound of antipyrine and iron chloride which is said to check bleeding.

ACETANILID (ANTIFEBRINE)

Acetanilid is a white crystalline powder formed by the action of glacial acetic acid, on anilin, a chemical substance which is an ingredient of many dyes. It is a neutral substance and does not form salts with acids. Chemically it is **phenylacetamid.** It is not readily dissolved in water.

Appearance of the Patient

About fifteen to twenty minutes after an average dose of acetanilid is given, the patient feels calm and quiet, and does not complain of headache or nervous pains from which

he may have been suffering. If the patient has a high temperature, it is reduced about one or two degrees or even to normal, in several hours. The temperature remains down for about six to seven hours.

The face is flushed, perhaps even purple in color. The pulse gradually becomes slower and stronger and the breathing is slower.

ACTION

Local action: Applied to the skin or mucous membranes, acetanilid relieves pain and is an antiseptic.

Internal Action

In the mouth: It has a bitter taste.

In the stomach and intestines: The secretions are increased and it rarely causes nausea and vomiting.

Action after Absorption

Acetanilid is absorbed into the blood in about half an hour. Here it is changed to **paramidophenol**, a simpler chemical substance which produces most of its effects. After absorption it affects principally the brain, the temperature, the heart and the blood.

Action on the brain: Acetanilid is soothing to the brain. **It relieves neuralgic pains and nervous headache,** making the patient calm and quiet. In large doses, it occasionally produces light sleep.

Action on the spinal cord: Acetanilid lessens the reflex action of the spinal cord, so that the patient does not respond so readily to external stimuli.

Effect on the temperature: The temperature is lowered one or two degrees or even to normal, in about two to three hours, and it remains down for about six to seven hours.

Action on the circulation: Acetanilid makes the pulse rapid at first, but it soon becomes slower and somewhat stronger because of the increased blood pressure.

Action on the blood: Acetanilid usually affects the red blood corpuscles. It changes the haemoglobin to methaemoglobin, a substance which cannot readily take up oxygen

from the lungs. **This causes the purple or even blue color of the face and extremities,** often noticed after acetanilid is given. With large doses the haemoglobin may even be set free in the blood.

Action on the respiration: The breathing is usually made slow and shallow.

Action on the secretory glands: The perspiration is only slightly increased by acetanilid, but it increases the flow of urine.

Excretion

Acetanilid is excreted by the urine in about twelve to twenty-four hours as paramidophenol sulphate.

Idiosyncrasies

In some individuals, acetanilid occasionally causes the following unusual symptoms:

1. Skin eruptions, principally areas of redness with itching.
2. Ringing in the ears.
3. Collapse.

Poisonous Effects

The poisonous effects of acetanilid are due principally to the formation of **methaemoglobin,** which prevents the red blood cells from combining with oxygen.

Acute Poisoning

A single overdose of acetanilid usually causes:

1. Nausea and vomiting.
2. **Cyanosis, blue color of the face and extremities.**
3. **Rapid, weak, irregular, thready pulse.**
4. **Shortness of breath with difficult breathing.**
5. Cold, moist skin.
6. Subnormal temperature.
7. Collapse.
8. Stupor, coma and death.

Chronic Poisoning

This is by far the most common form of acetanilid poison-

ing and results from the indiscriminate use of headache powders containing acetanilid.

Symptoms

1. Cyanosis.
2. Shortness of breath.
3. Rapid, irregular, thready pulse.

Administration

Acetanilid is best given in wine, whiskey or syrup after meals. It is usually combined with caffeine, to overcome its weakening action on the heart.

Preparations

Acetanilid (Acetanilidum)	0.06–0.6 gm.	grs. i–x
Compound Acetanilid Powder (Pulvis Acetanilidi Compositus)	0.5 gm.	grs. viii

This consists of 7 parts of acetanilid, 1 part of caffeine and 2 parts of sodium bicarbonate.

PHENACETINE (ACETPHENETIDIN)

Phenacetine or acetphenetidin, is a white crystalline powder derived from paramidophenol.

Appearance of the Patient

About fifteen minutes to a half an hour after an average dose of phenacetine is given, the patient is relieved of neuralgic pains or headache from which he may have been suffering. If he has temperature, it may be reduced about three degrees or even to normal in about three to four hours accompanied by profuse sweating. The pulse and respiration are usually not very much affected.

ACTION

Local action: Applied to the skin or mucous membranes, it slightly relieves pain and is an antiseptic.

Internal Action

In the mouth: It has a bitter taste.

In the stomach and intestines: It increases the secretions occasionally causing nausea.

Action after Absorption

Phenacetine is absorbed into the blood from the stomach; usually in about a half to one hour. After absorption it affects principally the nervous system, the temperature and the blood.

Action on the nervous system: Phenacetine is soothing to the nervous system. **It relieves neuralgic pains and headache,** and makes the patient calm and quiet.

Effect on the temperature: Phenacetine reduces the temperature in fevers about three degrees or even to normal, in three to four hours. The temperature remains down for several hours, and its reduction is accompanied by profuse sweating. It occasionally lowers the normal temperature slightly.

Action on the blood: Phenacetine affects the red blood corpuscles; **changing their haemoglobin to methaemoglobin** which is unable to combine with the oxygen. This often causes a purple color of the face or extremities, or even cyanosis.

The heart and respiration are very little or not at all affected by phenacetine. It is therefore a safer drug than either antipyrine or acetanilid.

Poisonous Effects

Overdoses of phenacetine cause:

1. Cyanosis.
2. Shortness of breath.
3. Weak pulse.
4. Stupor.

Preparations

Phenacetine (Acetphenetidinum)	0.3–1.0 gm.	grs. v–xv
Thermodin or Phenacetine Urethane (not official) (Acetylparethoxy)	0.3–1.0 gm.	grs. v–xv

This is a compound of phenacetine and urethane. Its effects are similar to those of phenacetine.

NEW AND NON-OFFICIAL ANTIPYRETICS

There are a large number of drugs made from coal tar, which are frequently used as antipyretics, but they are not official. Many of them are said to be safer than either antipyrine, acetanilid, or phenacetine. Only the most important ones are given here, as new ones are constantly being made.

Many patent headache powders contain antipyretics, and these frequently produce poisonous effects from their continued use.

PYRAMIDON

Pyramidon is an artificial chemical substance which acts like antipyrine. It relieves nervous pains and headaches. It reduces temperature slowly, but the temperature stays down longer. It is usually given together with caffeine, because of its weakening action of the heart.

Preparations

Pyramidon (Dimethylaminoantipyrina)	0.06–0.4 gm.	grs. i –vi
Pyramidon Acid Camphorate	0.6 –1.0 gm.	grs. x –xv
Pyramidon Neutral Camphorate	0.5 –0.8 gm.	grs. viii–xii

The last two preparations are said to be safer than pyramidon.

Triphenin	0.3–1.0 gm.	grs. v–xv

This is a derivative of phenacetine. It acts like phenacetine, but its effects are slow and milder.

PHENOCOLL

Phenocoll is an artificial chemical substance which acts like phenacetine, but it is said to be safer. It has been used as a substitute for quinine in malaria.

Preparations

Phenocoll Hydrochloride	0.3–1.3 gm.	grs. v –xx
Phenocoll Salicylate	1.0–2.0 gms.	grs. xv–xxx

This combines the effect of phenocoll with salicylic acid, and is used to relieve rheumatic pains.

Salocoll	0.5–1.0 gm.	grs. viii–xv

The following less important unofficial antipyretics are occasionally used. Their effects are similar to those of the other antipyretics.

Thalline	0.2 –0.5 gm.	grs. iii–viii
Exalgine	0.06–0.6 gm.	grs. i –x

This resembles acetanilid in its action, but it is said to be safer. It occasionally causes dizziness, trembling and weakness of the eyelids.

Lactophenine	0.5–1.0 gm.	grs. viii–xv
Thermodine	0.5–1.0 gm.	grs. viii–xv
Neurodine	0.5–1.0 gm.	grs. viii–xv
Malakine **Saliphen** **Salophen**	0.5–1.0 gm.	grs. viii–xv

These substances break up in the body, forming salicylic acid. They therefore relieve rheumatic pains, besides lowering the temperature. Malakine occasionally produces sweating.

Antikamnia **Antinervine** (Consisting of ammonium bromide, salicylic acid and acetanilid.) **Benzanilide** **Exodyne** **Phenolide** **Analgen**	0.6–1.0 gm.	grs. x–xv These are proprietary preparations which produce the same effects as acetanilid.
Hydracetine **Iodophenine** **Methacetine** **Thymacetine**	0.2–0.6 gm.	grs. iii–x These are proprietary preparations which act like phenacetine.
Asaprol	0.3–2.0 gms.	grs. v–xxx

This relieves pain, reduces temperature, checks bleeding, lessens nervousness, produces sleep, and increases the flow of urine. It occasionally increases the perspiration. It is often used as lotions of 1–5% solutions.

Migrainin 1.0 gm. grs. xv

This consists of antipyrine, caffeine and citric acid.

USES OF THE ANTIPYRETICS

The antipyretics were originally used principally to reduce fever. Owing to their weakening action on the heart, and to the formation of methaemoglobin, which most of them cause, they are not used for this effect as much as formerly. Cold baths, cold sponges, etc., have taken their place. These are preferable to reduce fever, as they do not affect the heart or blood.

The antipyretics are very useful drugs, however, and are now principally used to relieve indefinite pains and nervous headaches.

Better results are often obtained by combining small doses of several of these drugs, instead of giving an average dose of a single one. They are usually given together with caffeine, or some other heart stimulant, to overcome the weakening action on the heart.

There are several combinations of antipyretics which are commonly used to relieve headache and nervousness, such as

Caffeine
Acetanilid } C. A. P. Capsules
Phenacetine

or

Pyramidon
Caffeine

These combinations are usually put up in capsules or powders. There are numerous headache powders on the market, which consist mainly of one or a number of these various antipyretics.

TABLE OF COMPARATIVE ACTION OF PRINCIPAL ANTIPYRETICS

Name of Drug	Anodyne Action	Effect on Temperature	Action on the Heart	Action on the Respiration	Action on the Blood	Poisonous Effects
Antipyrine.	Relieves neuralgic pains.	Lowered 1–3 degrees for 2–3 hours.	Pulse faster at first, then slower.	Breathing faster at first, then slower.	Checks bleeding.	Occasional collapse.
Acetanilid.	Same.	Lowered 1–2 degrees for 6–7 hours.	Pulse faster at first, then slow and strong.	Breathing slower.	Cyanosis.	Collapse.
Phenacetine.	Same.	Lowered 2–3 degrees for 3–4 hours, with profuse sweating.	No effect.	No effect.	Same.	
Pyramidon.	Same.	Lowered 2–3 degrees for 4–5 hours.	Pulse faster at first, then slower.	Breathing faster at first, then slower.		Collapse occasionally.
Phenocoll.	Same.	Lowered 1–2 degrees for 2–3 hours.	Slight effect.	Slight effect.		

ANTISPASMODICS

Antispasmodics are drugs which relieve "nervousness."

The following drugs relieve various indefinite symptoms known as nervousness. These symptoms occur in hysteria and neurasthenia. In these conditions patients are more susceptible to all sensory impulses, and they are more emotional. They are usually restless, they lack concentration, and suffer from lack of sleep. They are usually more irritable and have all sorts of indefinite pains and aches. These symptoms are relieved by many of the drugs in this group in an unknown way. Probably, they produce their effects by suggestion. Most of them have a very strong unpleasant odor, which makes the patients think they are taking a very efficient remedy and the symptoms therefore improve.

Because these drugs often relieve the nervous twitchings of the muscles, as well as the other symptoms of neurasthenia or hysteria, they are often called **antispasmodics.**

VALERIAN

Valerian is obtained from the roots and underground stems of the **Valeriana officinalis,** a European plant. Its active principle is a volatile oil which has a very unpleasant odor; especially when it is old. It also contains valerianic acid and other substances. It was formerly used in England as a perfume.

Appearance of the Patient

After a preparation of valerian is given, the patient becomes calm and quiet and his nervousness is lessened.

ACTION

Valerian has no local action.

When given internally, it produces the following effects:

1. It has an unpleasant taste and odor, it checks the formation and aids in the expulsion of gas from the stomach (carminative action).

2. **It allays nervousness,** and makes the patient calm and quiet; probably because of its unpleasant taste and odor.
3. It makes the pulse a little faster and stronger.
4. It is said to increase the sweat and the urine.

Preparations

Fluidextract of Valerian (Fluidextractum Valerianae)	2.0–4.0 c.c.	ʒ ½–i
Tincture of Valerian (Tinctura Valerianae)	4.0–12.0 c.c.	ʒ i –iii
Ammoniated Tincture of Valerian (Tinctura Valerianae Ammoniata)	4.0–12.0 c.c.	ʒ i –iii

New and Non-official Preparations

Valyl (Valeryldiethylamidum)	0.12 gm.	grs. ii

This usually comes in "pearls," two or three of which are given after meals.

Validol (Menthyl Valerianate)	0.6–1.0 c.c.	m. x–xv

This is a compound of menthol and valerianic acid. It acts like valerian, but is much more pleasant to the taste and has a marked carminative action. It is best given in 10 to 15 drop doses on a lump of sugar.

Validol Camphorate	0.6–1.0 c.c.	m. x–xv

This acts like validol, but because of the camphor which it contains, it is somewhat strengthening to the heart, and it relieves pain when locally applied.

Bornyval	0.25–0.75 c.c.	m. iv–xii

This is **Borneol isovalerate,** which forms a large part of the oil of valerian, the active principle of valerian.

Brovalol	0.25–0.75 c.c.	m. iv–xii
Gynoval	0.25–0.5 gm.	grs. iv–viii

This acts like valerian but it is more pleasant to take.

ASAFOETIDA

Asafoetida is a gum resin obtained by incising the root of the **Ferula narthex,** a plant which grows in Afghanistan in India. It consists of a gum resin and a volatile oil which is the active principle. Asafoetida is frequently used in India as a condiment.

Appearance of the Patient

After giving an average dose of asafoetida, the patient complains of its unpleasant taste. He becomes calm and quiet and less nervous.

ACTION

Local action: Applied to the skin or mucous membrane, it causes slight redness.

Internal Action

In the mouth: It has a very unpleasant nauseous taste, and an odor resembling garlic.

In the stomach: It checks the formation and aids the expulsion of gas (carminative action), and it increases the secretions. **In the intestines:** It increases the secretions and peristalsis and helps to expel gas. It causes frequent movements of the bowels.

Action after Absorption

Asafoetida is readily absorbed from the stomach. After absorption, it slightly increases the secretion of saliva, sweat and urine. The secretion of mucus from the bronchi is also increased. It acts therefore as a stimulating expectorant. Asafoetida acts as a disinfectant on all the secretions.

Action on the nervous system: Asafoetida makes the patient calm and quiet and allays nervousness; probably because of the suggestion produced by its very unpleasant taste and odor.

Poisonous Effects

Overdoses of asafoetida produce severe nausea and vomiting.

Preparations

Emulsion of Asafoetida (Emulsum Asafoetidae)	15.0–30.0 c.c.	ʒ ½–i

This is given by mouth, or in an enema; to relieve distention.

Tincture of Asafoetida (Tincture Asafoetidae)	1.0–2.0 c.c.	m. xv–xxx
Pills of Asafoetida (Pillulae Asafoetidae)	1 –3 pills	

Each pill contains 0.2 gm. (grs. iii) of asafoetida.

MUSK (MOSCHUS)

Musk is the dried secretion of the glands situated in front of the prepuce of the **Moschus moschiferus,** or the musk deer of Thibet. It is a dark brown substance, with a very strong characteristic odor.

ACTION

Owing to the difficulty of obtaining a reliable preparation, musk often produces no effects. If the preparation is a good one, it produces the following effects:

1. **It relieves nervousness** and calms and quiets the patient.
2. It is said to make the pulse stronger and faster.
3. It often relieves hiccough.

Large doses have occasionally caused headache, dizziness, confusion, and muscular twitchings followed by sleep.

Preparations

Musk (powder) **(Moschus)**	0.5–1.0 gm.	grs. viii–xv
Tincture of Musk (Tinctura Moschi)	4.0–8.0 c.c.	ʒ i–ii

SUMBUL

Sumbul or vegetable musk is obtained from the root and underground stems of the **Ferula sumbul,** a plant which is very little known. Its active principle is a volatile oil.

It is used principally to allay nervousness and make the patient calm and quiet. It may be given in large doses.

Preparations

Extract of Sumbul (Extractum of Sumbul)	0.25 gm.	grs. iv
Fluidextract of Sumbul (Fluidextractum Sumbul)	2.0 c.c.	m. xxx

CIMICIFUGA (BLACK SNAKEROOT)

Cimicifuga is obtained from the roots and underground stems of the **Cimicifuga racemosa,** an American plant which grows abundantly in shady woods. Its active principle is probably a volatile oil, though it also contains a resin and tannic acid.

ACTION

When given internally, cimicifuga produces the following effects:

1. **It lessens nervousness** and quiets the patient.
2. It increases the appetite and aids digestion.
3. It increases the secretion of sweat and urine.
4. It increases the secretion of the bronchi, and acts as an expectorant.

Large doses cause symptoms resembling those of digitalis poisoning.

1. Slow, strong pulse.
2. Slow and shallow breathing, headache, dizziness and weakness.

Preparations

Extract of Cimicifuga (Extractum Cimicifugae)	0.3–1.0 gm.	grs. v–xv
Fluidextract of Cimicifuga (Fluidextractum Cimicifugae)	1.0–4.0 gms.	m. xv–ʒ i
Tincture of Cimicifuga (Tinctura Cimicifugae)	4.0–8.0 c.c.	ʒ i–ii

HUMULUS LUPULUS (HOPS)

Hops are the dried cones which consist of scales, of the **Humulus lupulus,** or hop vine, a plant growing in England, northern Europe, and the United States. At the base of the scales, there is a yellow powder called **lupulin.** The active principle of hops is a volatile oil.

ACTION

When locally applied, hops relieves pain and causes redness of the skin.

When taken internally, it produces the following effects:

1. It increases the appetite and aids digestion.
2. It is soothing to the brain and lessens nervousness, and may even produce light sleep.
3. It contracts mucous membranes.
4. It is said to increase the perspiration.

Administration

Locally, hops are usually applied in the form of bags containing the crude hops. These are soaked in water, wrung out, and applied locally. They are often used dry and heated, for local effect, or as pillows to produce sleep.

Preparations

Lupulin (powder) **(Lupulinum)**	0.3–1.2 gm.	grs. v–xx
Fluidextract of Lupulin (Fluidextractum Lupulini)	2.0–8.0 c.c.	ʒ ½–ii
Oleoresin of Lupulin (Oleoresinae Lupulini)	0.1–0.3 gm.	grs. ii–v

COMPOUND SPIRITS OF ETHER (HOFFMAN'S ANODYNE)

Compound spirits of ether, or Hoffman's anodyne, is used principally to lessen nervousness and calm the patient. It also checks the formation of gas in the stomach. Its effect is due principally to the ethereal oil, or oil of wine, which it contains. This is a substance which is formed by

distilling alcohol with sulphuric acid and then diluting the resulting fluid with ether.

Preparations

Compound Spirits of Ether (Spiritus Aetheris Compositus) (Hoffman's Anodyne)	2.0–4.0 c.c.	ʒ ½–i

The following preparations are occasionally used to relieve nervousness and to make the patient calm and quiet.

Acetic Ether (Aether Aceticus)	1.0 c.c.	m. xv

This resembles ether, but it does not evaporate very easily.

Monobromated Camphor (Camphora Monobromata)	0.3–1.0 gm.	grs. v–xv

This resembles camphor in its action.

Camphor is also used to lessen nervousness and quiet the patient.

CYPRIPEDIUM

Cypripedium is obtained from the roots and underground stems of **Cypripedium pubescens** or ladies' slipper, and from **Cypripedium parviflorum** or moccasin plant, two American plants. The active principle of these plants is a volatile oil.

It relieves nervousness and quiets the patient and it has been used for a substitute for valerian.

Fluidextract of Cypripedium (Fluidextractum Cypripedii)	1.0–2.0 c.c.	m. xv–xxx

SCUTTELARIA

Scuttelaria is obtained from the **Scuttelaria lateriflora** or skull cap, an American plant. It relieves nervousness and quiets the patient.

Fluidextract of Scuttelarium (Fluidextractum Scuttelariae)	4.0 c.c.	ʒ i

TUSSOL (not official)

Tussol or **Antipyrin mandelate,** is used in doses of 0.03–0.3 gm. (grs. ½–v), to lessen nervousness.

CHAPTER XVIII

DEPRESSO MOTORS

Depresso motors are drugs which lessen muscular contractions. The contractions of the muscles can be lessened in the following ways:

1. By acting on the muscles.
2. By acting on the nerve endings in the muscles.
3. By lessening the action of the motor cells in the gray matter of the spinal cord.
4. By lessening the action of the cells in the gray matter of the motor areas of the brain.

GELSEMIUM

Gelsemium is obtained from the roots and underground stems of the **Gelsemium sempervirens,** yellow jasmine, or Carolina jasmine, a climbing plant of the southern United States. Its active principles are two alkaloids; **gelsemine** and **gelseminine,** the gelsemine being the more active of the two.

Appearance of the Patient

About fifteen minutes to a half hour after giving a dose of gelsemium, the patient feels tired and languid. The pulse is perhaps somewhat slower and weaker. If the patient has had muscular twitchings, these are lessened.

ACTION

The only local effect produced by gelsemium is the dilatation of the pupil, which follows its application to the conjunctiva.

Internal Action

When taken internally, gelsemium is readily absorbed into the blood in about fifteen to twenty minutes, and it

then affects principally the muscles, the respiration and slightly the heart.

Action on the muscles: Gelsemium lessens the contractions of the muscles by paralyzing their nerve endings, which receive the impulses to make them contract. In this way **it lessens muscular twitchings,** which are very fine muscular contractions.

Action on the respiration: Large doses of gelsemium make the breathing slow and shallow.

Action on the circulation: The pulse is made slower and weaker by large doses.

Excretion

Gelsemium is rapidly eliminated from the body by the urine, usually in about two to three hours.

Poisonous Effects

An overdose of gelsemium usually causes the following serious symptoms; which may often endanger the patient's life.

Symptoms

1. The patient becomes tired, languid and drowsy, but does not fall asleep.
2. The movements of the muscles become weak and unsteady, the jaw drops, the eyes may be tired, or the eyelids may droop, and the pupils dilate. The speech is often indistinct, and the patient staggers as soon as he attempts to walk. (These symptoms are due to the beginning paralysis of the muscles.)
3. Occasionally there is nausea and vomiting with profuse flow of saliva.
4. The skin is moist, cold and insensitive to pain.
5. The pulse is slow and weak.
6. The breathing becomes very slow and shallow, and death results from the paralysis of the breathing.

The patient is conscious to the last, though there may be partial blindness before death.

Treatment

1. Wash out the stomach.
2. Keep the patient quiet.
3. Give artificial respiration.
4. Give heart stimulants such as atropine, strychnine, etc.

Uses

Gelsemium is used principally to relieve the very painful spasms of the muscles of the face in "tic douleureux" or trigeminal neuralgia.

Preparations

Fluidextract of Gelsemium (Fluidextractum Gelsemii)	0.3–0.6 c.c.	m. v–x
Tincture of Gelsemium (Tinctura Gelsemii)	0.3–1.0 c.c.	m. v–xv

CONIUM (SPOTTED HEMLOCK)

Conium is obtained from the fruit and flowers of the **Conium maculatum,** or poison hemlock, a European plant. Its active principle is **coniine,** a volatile fluid alkaloid.

ACTION

Applied locally, conium causes intense redness and swelling.

When taken internally, it acts like gelsemium, causing muscular weakness by paralyzing the nerve of the muscles.

In large doses it slows the breathing.

Poisonous Effects

Conium poisoning has become famous as having been the means with which Socrates, the famous Greek philosopher was killed; poison hemlock being the means of killing criminals in Athens in Socrates' time.

Symptoms

1. The lower extremities become weak and heavy. The patient lies down because of the weakness. If he attempts

to walk, he staggers and falls. The eyes may be turned in, the lids may droop, and the pupils are dilated. The patient complains of headache and he can hardly lift his head.

2. The pulse is slow at first, but soon becomes rapid and weak.

3. The skin is moist and cold.

4. The breathing becomes slow and shallow, and the patient dies in a short time from arrest of breathing.

Uses

Conium is very rarely used at present, possibly once in a great while to lessen the spasms of whooping cough. It is a very dangerous drug.

Preparations

Fluidextract of Conium (Fluidextractum Conii)	0.1–0.5 c.c.	m. ii–viii

SPARTEINE

Sparteine is a fluid alkaloid which is contained in **scoparius** or broom tops.

ACTION

When given internally, its effects appear in half an hour and last for several hours. It is absorbed from the stomach, and it then acts like gelsemium or conium. It weakens muscular contractions by paralyzing the nerve endings in the muscles. It is not as poisonous as either of these drugs, but it affects the heart more.

Action on the heart: Sparteine makes the heart beat slower and weaker; by weakening the contractions of the heart muscle, thereby causing a slow, weak pulse.

Sparteine was formerly considered a heart stimulant, but its use for this purpose has been given up, as its action seems to contraindicate this use.

Sparteine does not increase the flow of urine as does scoparius, the crude drug from which it is obtained.

Poisonous Effects

The poisonous effects of sparteine are the same as those of conium.

Preparations

Sparteine Sulphate (Sparteinae Sulphas)	0.004–0.1 gm.	gr. $\frac{1}{15}$–ii

LOBELIA (INDIAN TOBACCO)

Lobelia is obtained from the leaves and tops of the **Lobelia inflata** or Indian tobacco, an American plant. Its active principle is an alkaloid **lobeline.**

ACTION

When taken internally, lobelia produces the following effects:

1. It increases the secretions of the stomach and intestines, often causing nausea and vomiting, and occasionally frequent movement of the bowels.
2. **It lessens the contractions of the involuntary muscles of the bronchi.**
3. It increases the secretions; such as the saliva, the mucus from the bronchi, etc.
4. The pulse is usually slower, but soon becomes rapid and weak.
5. The breathing is somewhat slower.

Poisonous Effects

An overdose of lobelia usually causes:

1. Nausea, and profuse vomiting.
2. Occasionally frequent movements of the bowels.
3. Great weakness and relaxation of the muscles.
4. Collapse (rapid thready pulse, slow shallow breathing, cold moist skin, and dilated pupils).
5. Convulsions, stupor, coma and death from paralysis of the breathing.

Uses

Lobelia is occasionally used to lessen the contractions of

the involuntary muscles of the bronchi, in asthma; but because of its dangerous poisonous effects, its use has mostly been given up. It is occasionally used in the form of an infusion, to relieve poison ivy rash.

Preparations

Fluidextract of Lobelia (Fluidextractum Lobeliae)	0.06–0.3 c.c.	m. i–v
Tincture of Lobelia (Tincture Lobeliae)	0.6–4.0 c.c.	m. x–ʒ i

TABACUM (TOBACCO) (not official)

Tobacco is the dried leaves of **Nicotiana tabacum**, a plant growing in tropical countries. It contains **nicotine**, a very poisonous volatile fluid alkaloid. It also contains **pyridine**, a substance which acts like nicotine, **tobacco camphor** and an oil.

Tobacco is not used as a medicine, but it is habitually used as a luxury by many individuals. It is smoked in the form of cigarettes or cigars, it may be chewed or taken as snuff.

ACTION

Tobacco, because of its nicotine acts like lobelia. **It lessens the contractions of all the involuntary muscles.** A strong cigar will often relieve an attack of asthma, by lessening the contractions of the involuntary muscles of the bronchi.

It increases the peristalsis and often acts as an excellent cathartic. It increases the flow of urine.

In persons who do not smoke habitually, tobacco often causes nausea, vomiting, headache, dizziness and weakness. In those who smoke habitually, it does not produce such effects.

Poisonous Effects

Nicotine is one of the most violent poisons known. It causes symptoms like those of lobelia poisoning, which come on very rapidly and cause death.

Chronic tobacco poisoning is a frequent condition which

follows excessive smoking. The symptoms are due to the nicotine which the tobacco contains. The patient usually complains of **palpitation of the heart, he has a rapid irregular pulse** and is **very nervous.**

CURARA (not official)

Curara, woorara, woorali or urari, is an arrow poison which is used by the South American Indians. It is made from the bark of various trees, such as the **Strychnos toxifera.** Its active principle is an alkaloid, **curarine.** It is rarely used in practical medicine, but it is frequently used in animal experiments.

Curara paralyzes the nerve endings of all the muscles, thereby lessening their contractions. It causes a rapid weak pulse, by making the heart beat faster as a result of the paralyzed nerve endings of the Vagus nerve in the heart, which curara causes. The blood pressure is lowered, however.

It increases peristalsis and all the secretions. Curara is occasionally used to lessen the spasms of tetanus, hydrophobia, etc., but its use is dangerous on account of its weakening action on the heart. It is given in doses of gr. $\frac{1}{2}$; or curarine, the alkaloid is given in doses of gr. $\frac{1}{200}$–$\frac{1}{100}$.

For other drugs which lessen contractions of involuntary muscles, see the **belladonna group** and **morphine.**

UTERINE SEDATIVES

The following drugs are used principally to lessen contractions of the uterus, and to lessen the pains which these often produce.

VIBURNUM PRUNIFOLIORUM (BLACK HAW)

Viburnum is obtained from the root of the **Viburnum prunifoliorum** or black haw, a small American plant.

ACTION

It lessens the contractions of involuntary muscles, especially the muscles of the uterus. It soothes uterine contractions, and is said to check colic and cramps.

It is used principally to relieve painful or excessive menstruation, and to relieve the pains of ovarian disease.

Preparations

Fluidextract of Viburnum Prunifoliorum	2.0–16.0 c.c.	ʒ ½–iv
(Fluidextractum Viburni Prunifolii)		

VIBURNUM OPULUS (CRAMP ROOT)

Viburnum opulus, or cramp root, is obtained from the bark of the **Viburnum opulus,** a small American tree.

It acts like viburnum prunifoliorum, but is less soothing to the uterus and is said to relieve colic and cramp-like pains, more than viburnum prunifoliorum.

Preparations

Fluidextract of Viburnum Opulus	2.0–16.0 c.c.	ʒ ½–iv.
(Fluidextractum Viburni Opuli)		

There are a number of drugs which lessen, or soothe uterine contractions, but which have other more important effects. The most common of these are:

Morphine
Atropine
Antipyretic group
(Acetanilid)
(Antipyrine)
(Phenacetine)
(Pryamidon)

SECRETORY DEPRESSANTS

Secretory depressants are drugs which are principally used to check the secretions of the various secretory glands of the body.

The most efficient and best drugs for this purpose are the drugs belonging to the belladonna group, which have already been described under their other more important effects.

AGARICUS AND AGARICIN

Agaricus is a fungus, the **white agaric, or Agaricus albus or Boletus laricis.** This fungus grows on the European larch tree.

Its active principle is an acid, **agaricinic acid,** or agaricin, which is the preparation principally used.

ACTION

Agaricin checks the secretion of sweat, by paralyzing the nerve endings in the sweat glands which cause secretion. The effect however, is not as marked as after atropine. Secretions of the other secretory glands are not affected by agaracin. It often causes nausea and frequent movements of the bowels. It does not affect the heart, respiration or pupil. It is used principally to check the night sweats of tuberculosis.

Preparations

Agaricin 0.005–0.06 gm. gr. $\frac{1}{12}$–i

This is best given in pill form about five or six hours before retiring, as it is very slowly absorbed.

Agaric Acid (not official) 0.015–0.03 gm. grs. $\frac{1}{4}$–$\frac{1}{2}$
(Acidum Agaricum)

This is a very poisonous substance. Overdoses cause vomiting, diarrhoea and collapse.

CAMPHORIC ACID

Camphoric acid is a small white crystalline powder, formed by the action of nitric acid on camphor. It is used to check sweating.

Camphoric Acid (Acidum Camphoricum)	1.0–2.0 gms.	grs. xv–xxx
THALLEIN ACETATE	0.06–0.2 gm.	grs. i–iii

This is a white crystalline powder used to check night sweats. Its continued use is said to cause baldness.

PART IV—SPECIFICS

CHAPTER XIX

SPECIFICS

Specifics are drugs which are principally used to cure a particular disease. This effect is produced by destroying or neutralizing the causative agent of that disease. The best example of this action, is the effect of quinine in malaria. The organism which causes this disease is destroyed by the quinine.

Many of the specifics relieve the symptoms of a particular disease, though the mode of action may be unknown. An example of this action is the effect of the salicylates in rheumatism.

CINCHONA AND QUININE

Quinine is a white powder, an alkaloid, the active principle of **cinchona,** or peruvian bark. This is the bark of the cinchona tree, which grows in the Andes or other mountainous districts on the western coast of South America, though the tree has been cultivated successfully in other parts of the world, as in India and Java. There are two kinds of cinchona; **Cinchona rubra,** or red bark, and **Cinchona calisaya,** or yellow bark. The effects of both of these forms of cinchona are the same, but the yellow bark contains more quinine.

Cinchona is named in honor of the countess of Cinchon, a Spanish countess who was cured in 1638, of a disease that was then known as the ague, but what we now know as malaria. The drug had just been introduced in medicine in that time, having been brought to Spain by the Spanish explorers who learned of its use from the South American Indians. Besides **quinine,** the active alkaloid; cinchona contains the alkaloids **quinidine, conquinine, cinchonine,** and **cin-**

chonidine which resemble quinine in their effects, but they are weaker.

Appearance of the Patient

When quinine is given to a patient suffering from malaria, it prevents the chills, fever and sweats, which are characteristic of that disease.

After administration of a single average dose of quinine, the patient usually complains of a bitter taste in the mouth, he feels brighter, and the pulse is perhaps somewhat faster and stronger. If the patient has temperature, this is lowered several degrees.

If the quinine is given for some time, the patient feels better, he has a better appetite, his bowels move more regularly, he feels brighter and stronger and is more active. The pulse is somewhat stronger and faster, the breathing is deeper and somewhat faster.

ACTION

Quinine affects all living tissues (protoplasm). It increases their activities at first, but soon lessens them. All the effects of quinine are due to this action. Quinine has no special affinity for any particular organ or tissue.

Various living organisms such as amoebae, bacteria, etc., are destroyed by quinine.

Local action: Applied to the skin or mucous membranes, quinine causes slight redness and acts as an antiseptic. It is not generally used as an antiseptic, because it is too expensive.

Internal Action

In the mouth: Quinine has a very bitter taste because of which it increases the appetite and the secretion of saliva.

In the stomach: It increases the secretion of gastric juice and aids digestion. In large doses, it occasionally causes nausea and vomiting.

In the intestines: It increases the secretions and peristalsis, often causing frequent movements of the bowels.

Action after Absorption

Quinine is slowly absorbed into the blood, principally

from the stomach. It begins to be absorbed in about 15 minutes, but it is not completely absorbed until about four or five hours. If a drop of dilute sulphuric acid is added to any of the preparations, the drug is more readily absorbed. When it enters the blood, it acts as a specific against malaria, and it slightly affects the nutrition and the action of all the tissues and organs.

SPECIFIC ACTION IN MALARIA

Malaria

Malaria is a disease caused by a unicellular organism, a protozoan called the **Plasmodium malariae.** This organism is injected into the blood of the patient, by the bite of a species of mosquito, the **anopheles.** The organisms then enter the red blood corpuscles, where they grow and develop into other similar organisms in 48 or 72 hours, depending on the type of organism. At the end of this time, the red blood corpuscles burst, the newly formed malarial parasites, and the haemoglobin of the red blood corpuscles, are thrown into the blood.

As a result of the sudden destruction of such a large number of red blood corpuscles, the patient has a chill. The violent muscular contractions which are thus produced, elevate the temperature several degrees, and since this temperature is excessive, it is followed by sweating, which gradually reduces it to normal.

These chills, fever and sweats occur every third day, if the organism which causes these symptoms is the **quartan type,** or the one which develops in 72 hours. It occurs every other day, if the organism is the **tertian** type or the one which develops in 48 hours. In some cases, the chills, fever and sweats occur every day. This is due to the patient having two tertian types of organisms, each one developing in 48 hours, but on alternate days. The attacks always come on regularly at the same time during the day.

Effect of Quinine in Malaria

If a patient suffering from malaria is given quinine, **the**

quinine enters the blood and destroys the plasmodiae. The chills, fever and sweats are then prevented, and the disease is cured. The quinine must be continued for some time, however, even after the symptoms have disappeared; until all the plasmodiae in the blood are destroyed, and the patient has no more attacks.

Action on the nutrition and metabolism: Quinine increases the nutrition of the tissues and organs of the body, by preventing the nitrogenous, or proteid food from being used up (combining with oxygen). These foods help to build up the patient and conserve the strength. In this way **quinine acts as a tonic,** slightly improving the action of all the tissues and organs of the body and making the patient feel better and stronger.

Action on the blood: Besides its destructive action on malarial parasites, quinine prevents the red blood corpuscles from taking up oxygen as readily as before. It also lessens their number and checks the movements of the white blood corpuscles.

Action on the circulation: The pulse is made somewhat stronger and faster, because the contractions of the heart and blood vessels are increased. Large doses, occasionally cause a slow and weak pulse because of the lessened contractions of the heart.

Action on the nervous system: Quinine makes the patient somewhat brighter and more active.

Action on the senses of sight and hearing: Large doses of quinine very frequently cause **ringing in the ears,** and **dimness of vision.**

Action on the uterus: Quinine increases the contractions of the uterus during labor, only occasionally causing abortion, however.

Effect on temperature: The temperature is lowered because oxidation of the nitrogenous or proteid substances of the tissues is lessened, and less heat is produced.

Excretion

Quinine is eliminated from the body by the urine, mostly in about 6 to 8 hours.

Idiosyncrasies

Many individuals are especially susceptible to quinine, even small doses causing poisonous effects. In some individuals, the following unusual symptoms occur, even from very small doses.

1. Eruptions on the skin, such as areas of redness resembling the scarlet fever rash, hives or urticaria, and occasionally small blisters. (Herpes.)
2. Occasionally scanty urine, accompanied by pain; often the urine is tinged with blood or haemoglobin.
3. Slow and weak pulse, and a feeling of weakness.

Poisonous Effects

Since quinine is very frequently given in large doses for malaria, poisonous effects are not uncommon. These effects result from continued use of quinine, or from very large doses taken to produce abortion. While the symptoms which result may be alarming, they are rarely, if ever, fatal.

Symptoms

The first and most characteristic symptom of quinine poisoning is:

1. **Ringing in the ears,** or roaring sounds in the ears. Often the patient may become temporarily deaf. Rarely the deafness remains permanent.
2. **Dimness of vision,** especially for colors.
3. Temporary blindness or "color blindness." The blindness is occasionally permanent.
4. Nausea and vomiting.
5. Slow, weak pulse.
6. Muscular weakness.
7. Collapse.

Treatment

The symptoms usually subside when the drug is stopped. If the pulse is weak, caffeine, given hypodermically, or a hot coffee enema, usually improves it.

Uses

Quinine is used principally:

1. **As a specific in malaria.**

2. As a bitter, to increase the appetite and to improve the nutrition; as a tonic.

3. To reduce fever.

4. In amoebic dysentery, a chronic disease of the intestines caused by the amoeba, a unicellular organism. In these cases quinine is usually given by irrigations into the colon or large intestine. It acts by destroying the amoebae.

Administration

In malaria, quinine is usually given in one single large dose of 1.0 gm. (grs. xv) about 4 hours before the time when the chill should occur. It may also be given in divided doses, so that the last dose is given about **4 hours before the expected chill.** By the time the quinine enters the blood, the parasities are very young and are readily destroyed. It may also be given in divided doses when the temperature is going down, **after the chill.** The administration of quinine should be kept up, however, for about a week after the attack is over, to prevent a recurrence of the symptoms.

1. Quinine is best given in solution, as it is then more readily absorbed.

2. It may also be given in powder or pills. Quinine pills are usually not very efficient unless they are fresh. Otherwise, they may pass out into the stools and are not absorbed. The addition of a few drops of dilute sulphuric acid usually makes the quinine preparation more soluble.

3. On account of its unpleasant, bitter taste, quinine should be given in sherry wine, in cachets of capsules, or some food, such as olive oil, may be given afterwards.

4. It is best given before meals, as it then increases the appetite, and prevents nausea and vomiting.

Preparations

Cinchona

Fluidextract of Cinchona (Fluidextractum Cinchonae)	4.0 c.c.	ʒ i

Tincture of Cinchona (Tinctura Cinchonae)	4.0–16.0 c.c.	ʒ i–iv
Compound Tincture of Cinchona (Tinctura Cinchonae Composita)	2.0–4.0 c.c.	ʒ ½–i

The cinchona preparations are used principally as bitters to increase the appetite. For malaria and as a tonic, quinine preparations are preferable.

Quinine

Quinine (Quinina)	0.3–1.0 gm.	grs. v–xv
Quinine Bisulphate (Quininae Bisulphas)	0.3–1.0 gm.	grs. v–xv

This is the most common preparation used, as it is the most soluble one.

Quinine Sulphate (Quininae Sulphas)	0.3–1.0 gm.	grs. v–xv
Quinine Hydrobromide (Quininae Hydrobromidum)	0.3–1.0 gm.	grs. v–xv
Quinine Hydrochloride (Quininae Hydrochloridum)	0.3–1.0 gm.	grs. v–xv

Other Alkaloids of Cinchona

Cinchonine Sulphate (Cinchoninae Sulphas)	0.5–1.3 gm.	grs. viii–xx
Cinchonidine Sulphate (Cinchonidinae Sulphas)	0.5–1.3 gm.	grs. viii–xx

Compound Preparations

Iron and Quinine Citrate (Ferri et Quininae Citras)	0.3–0.6 gm.	grs. v–x
Syrup of Iron, Quinine and Strychnine Phosphate (Syrupus Ferri, Quininae et Strychninae Phosphatum)	4.0 c.c.	ʒ i
Elixir of Iron, Quinine and Strychnine Phosphate (Elixir Ferri, Quininae et Strychninae Phosphatum)	4.0 c.c.	ʒ i
Warburg's Tincture		

This is a dark brown liquid which is used extensively in India, in the treatment of malaria. It contains a large number of ingredients besides quinine, such as aloes, rhubarb, gentian, camphor, etc.

New and Non-official Preparations

Quinine and Urea Hydrochloride 0.3–1.0 gm. grs. v–xv
(Quininae et Ureae Hydrochloridum)

This preparation is suitable for hypodermic use. It is also used as a local anaesthetic when injected hypodermically or when applied to mucous membranes.

Quinine Tannate 0.6–2.0 gms. grs. x–xxx
(Quininae Tannas)

This preparation is slowly absorbed, and has no bitter taste.

Aristochin 0.3–1.0 gm. grs. v–xv

This is a chemical derivative of **quinine.** It is not so apt to cause poisonous symptoms.

Euquinine 0.3–1.0 gm. grs. v–xv
(Quininae Aethylcarbonas)

This is a chemical derivative of quinine, which is tasteless.

Chinaphenin 0.3–0.6 gm. grs. v–x

This is a compound of **quinine** and **phenacetine.** It combines the quinine action with the anodyne effect of phenacetine. It is tasteless and is not apt to cause poisonous symptoms.

Quinine Lygosinate
(Quininae Lygosinas)

This is a chemical derivative of **quinine.** It is used as an antiseptic dusting powder, or in solution to check bleeding.

Saloquinine 0.5–2.0 gms. grs. viii–xxx

This combines the action of quinine with salicylic acid.

Saloquinine Salicylate 1.0 gm. grs. xv

This acts like saloquinine.

Bebeerine 0.06–0.1 gm. grs. i–i½

This is an alkaloid which is occasionally used as a substitute for quinine.

PHLORIDZIN (not official)

Phloridzin is a glucoside obtained from the roots of the apple, pear, cherry, and other trees.

It is occasionally used to destroy malarial parasites. It forms sugar in the urine and increases its secretion. It is rarely used, except to test the action of the kidney; because it is injurious to that organ.

Preparations

Phloridizin (Phloridizinum)	0.3–0.6 gm.	grs. v–x

MERCURY (HYDRARGYRUM)

Mercury or quicksilver is a silver colored liquid metal which evaporates very easily. Many of its salts are used in medicine.

Appearance of the Patient

A few hours after giving an average dose of a preparation of mercury, the patient usually has several movements of the bowels. The stools are soft, colored with bile, and accompanied by a little griping; more urine is also passed. Occasionally the flow of saliva is also somewhat increased.

If small doses of mercury preparations are given continuously for weeks or longer, to a patient suffering from the first or second stage of syphilis, the symptoms, such as the original ulcer or chancre, the rash on the body, the mucous patches in the mouth, and the swelling of the glands, all gradually disappear.

ACTION

The salts of mercury combine with the proteids and albumins of all living matter, forming an albuminate of mercury. It is therefore injurious to, and may even destroy all living matter. In this way, it checks the growth of bacteria (antiseptic action), and other living organisms and parasites (antiparasiticide).

Local action: Applied to the skin, mercury preparations are excellent antiseptics. If a strong solution is used, or even a weak solution continuously, redness, pain and itching of the skin will result. If a strong solution is kept in contact with the skin for a long time, inflammation and even destruction of the skin may result.

Mucous membranes are shrunk and contracted by the action of mercury preparations (astringent action).

Internal Action

In the mouth: Mercury preparations have a distinct metallic taste, and contract the mucous membrane.

In the stomach: They slightly increase the secretions, occasionally causing nausea.

In the intestines: Mercury preparations increase the secretions and peristalsis, **causing frequent soft stools tinged with bile.** Here they also act as antiseptics. The large amount of bile in the stools which results when mercury preparations are given, is due to their antiseptic action; which prevents the decomposition of the bile, and also to the increased peristalsis of the bile ducts, induced by the peristalsis of the duodenum; the part of the intestine, to which these ducts are attached. Mercury preparations do not increase the secretion of bile, as was formerly supposed. The preparations of mercury, such as calomel, which are not readily absorbed, are the best ones to use as cathartics.

Action after Absorption

Mercury salts are readily absorbed into the blood from all the mucous membranes, the lungs, and even by the skin. When given by the mouth, they are absorbed in 1 to 2 hours. After absorption, they affect principally the intestines, the kidney, some of the secretions, the nutrition of the tissues, and if given for some time, they act as a specific against the first and second stages of syphilis.

Action on the kidneys: Mercury salts increase the flow of urine.

Action on the secretory glands: All the secretions, especially the saliva and pancreatic juice **are increased.**

Action on nutrition: Small doses of mercury preparations, if given for some time, increase the nutrition of the tissues, and the body weight. (Alterative action.)

SPECIFIC ACTION IN SYPHILIS

Syphilis

Syphilis is a chronic infectious disease, caused by the **Spirochaeta pallida,** a spiral shaped organism. The infection begins by the formation of a hard ulcer, or **chancre,** usually on the genital organs. This is known as the first stage of the disease. It is followed in about six weeks, by an eruption all over the body (**roseola**), whitish patches in the mouth (**mucous patches**), and **swelling of all the lymph glands** throughout the body. This is known as the second stage of the disease. In a short time, for example, in several months or several years or at any time during the patient's life, the patient may suffer from a number of diseases, which result from the formation of **gummata,** or areas of round cells which readily decompose and form a thick fluid in the center. Any organ of the body may be affected in this way, producing many and very different symptoms. This is known as the third stage of the disease.

Parents infected with syphilis, may transmit the disease to their children. The children may then be born dead, or they may suffer, if they live, at any time during their childhood from various symptoms which are characteristic of the third stage of the disease.

Effect of Mercury

Mercury preparations, if given continuously for some time, to a patient suffering from the first or second stage of syphilis, **usually relieve all the symptoms in a very short time.** The rash and the mucous patches soon disappear, the glands become smaller, until they too, finally disappear. This curative action of mercury in syphilis is probably due to its destructive action on the spirochaeta pallida, the organism which causes the disease.

Excretion

Mercury preparations are excreted mainly by the kidneys and the intestines, and also slightly, by all the excretions, such as the saliva, milk, bile, gastric juice, etc. It is eliminated from the body very slowly, usually in one or two days. Some of the mercury often remains in the body for a long time afterwards, and may then be gradually excreted for some time.

Poisonous Effects

Mercury poisoning occurs in two forms, acute poisoning and chronic poisoning.

Acute Mercury Poisoning

Acute mercury poisoning usually results from one of the mercury salts, such as the bichloride of mercury tablets, taken with suicidal intent.

Symptoms

1. Metallic taste in the mouth, and burning pain in the throat.
2. Cramp-like, abdominal pains.
3. Nausea and vomiting; the vomited matter contains bile and later blood.
4. Diarrhoea with bloody stools.
5. Scanty urine which may contain blood.
6. Collapse, as a result of the profuse vomiting and diarrhoea; rapid, weak, irregular pulse, the face is pinched and anxious, the skin is cold and moist, the breathing slow and shallow.
7. Convulsions and coma may occur before death.

Often the patient lives several days and then dies from severe injury to the kidney, which causes very scanty urine, convulsions and coma. Death from mercury poisoning usually occurs in from one to seven days.

Treatment

1. **The antidote for mercury poisoning is white of egg, milk or flour.** The albumins which these substances contain

combine with the mercury, forming an albuminate of mercury, which prevents the poisonous action of the mercury. About one egg should be given for every 4 grs. of bichloride of mercury taken.

2. Give opium or morphine to check the diarrhoea, and to keep the patient quiet.

3. Treat the collapse with heart stimulants such as caffeine, atropine, strychnine, etc.

Chronic Mercury Poisoning "Mercurialism"

Mercurialism or chronic mercury poisoning is a very common condition which results from prolonged use of mercury preparations. Syphilitic patients can often take large doses of mercury without producing any poisonous effects.

Symptoms

The first symptom of excessive mercury action is:

1. **Profuse flow of saliva,** and a metallic taste in the mouth. This is soon followed by:

2. **Soreness and bleeding of the gums,** later ulcerations of the gums, mouth or throat, loosening of the teeth, and even destruction of the jaw-bone. The breath has a very foul odor from the destroyed tissue.

3. **Diarrhoea,** often with bloody stools.

4. Anaemia.

5. Loss of weight.

6. Scanty urine.

7. Paralysis of the hands or feet with "drop-wrists" or "drop-feet."

Treatment

1. Stop the administration of mercury.

2. The soreness of the gums is best relieved by a potassium chlorate mouth wash or a tannic acid mouth wash. The gums are often painted with tincture of myrrh.

3. The diarrhoea is best checked by opium.

Uses

Mercury preparations are used principally:

1. **As a specific for the first and second stages of syphilis.**

2. Many of the preparations are excellent antiseptics.

3. Some of the preparations are excellent purgatives.

4. Mercury is said to have a very beneficial effect in relieving acute infections of the serous membranes, such as pleurisy, peritonitis; and enlargements of lymph glands.

Administration

1. For absorption from the skin, mercury is applied as **rubbings** or **inunctions** in the form of an ointment. This is applied for six days, every day on a different region of the body; thus, one day on the arms, another day on the forearms, the thighs, the legs, the back, etc. On the seventh day the patient is given a bath to get rid of the ointment on his skin and then the course is begun again.

In giving mercury inunctions, the nurse should protect her hands with thick gloves, as otherwise she herself may absorb the drug, and thus get poisonous effects.

Another method of giving mercury by the skin, is for the patient to sit in a cabinet over a **lamp containing calomel, which is then burned**; the fumes being absorbed by the skin. Mercury is also frequently given **by the mouth.**

An excellent newer method of giving mercury is **by deep injections into the muscles.** It is usually injected into the muscles of the buttocks, which are then rubbed very thoroughly to hasten the absorption.

Preparations

Bichloride of Mercury 0.0012–0.006 gm. gr. $\frac{1}{50}$–$\frac{1}{10}$
Corrosive Sublimate
(Hydrargyri Chloridum Corrosivum)

This is rarely used internally, but principally as a local antiseptic in 1–1000 to 1–5000 solutions. It usually comes in tablets of 0.5 gm. (grs. vii ½) each, which are dissolved in water to make up the required strength. Corrosive sublimate cannot be used to disinfect instruments, as it stains them black.

Mild Mercurous Chloride 0.006–0.3 gm. gr. $\frac{1}{10}$–v
Calomel
(Hydrargyri Chloridum Mite)

This preparation is used principally as a cathartic. It is given in tablets or as a dry powder on the tongue.

Blue Mass 0.1–0.5 gm. grs. ii–viii
(Massa Hydrargyri)

This is mercury rubbed with glycerin, honey, licorice, althaea, etc., and contains 33⅓% of mercury. It is used principally as a cathartic, in the form of pills; each pill containing 0.2–0.3 gm. (grs iii–v) of blue mass.

Mercury with Chalk 0.12–0.5 gm. grs. ii–viii
Gray Powder
(Hydrargyrum cum Creta)

This is a gray powder made like blue mass, but it contains chalk in addition to the other ingredients. It is used as a mild cathartic.

Yellow Iodide of Mercury 0.008–0.06 gm. gr. $\frac{1}{8}$–i
Protoiodide of Mercury
(Hydrargyri Iodidum Flavum)

Red Iodide of Mercury 0.0012–0.006 gm. gr. $\frac{1}{50}$–$\frac{1}{10}$
Biniodide of Mercury
(Hydrargyri Iodidum Rubrum)

Solution of Arsenic and Mercuric Iodides 0.3–1.3 c.c. m. v–xx
(Liquor Arseni et Hydrargyri Iodidi)
(Donovan's Solution)

This contains 1% each of arsenic iodide and the red mercuric iodide.

For Local Use

Mercurial Ointment
Blue Ointment
(Unguentum Hydrargyri)

This is made by thoroughly rubbing together mercury, oleate of mercury, lard and suet. It is used principally for inunctions.

Ointment of Yellow Mercuric Oxide
(Unguentum Hydrargyri Oxidi Flavi)

This contains 10% of yellow oxide of mercury.

Ointment of Red Mercuric Oxide
(Unguentum Hydrargyri Oxidi Rubri)

This contains 10% of red oxide of mercury.

Ointment of Ammoniated Mercury
(Unguentum Hydrargyri Ammoniati)

This contains 10% of ammoniated mercury.

Ointment of Mercuric Nitrate
(Unguentum Hydrargyri Nitratis)
Citrine Ointment

This contains 7% of mercuric nitrate.

New and Non-official Preparations

Black Wash
(Lotio Hydrargyri Nigra)

This consists of 4.0 gms. (ʒ i) of calomel to 500 c.c.(1 pt.) of lime water. It is used principally as an external application.

Yellow Wash
(Lotio Hydrargyri Flava)

This consists of corrosive sublimate 2.0 gms. (ʒ½) to 500 c.c. (1 pt.) of lime water. It is used principally as a local application.

Mercuric Cyanide 0.004–0.008 gm. grs. $\frac{1}{16}$–$\frac{1}{8}$
(Hydrargyri Cyanidum)

It is also used as a local antiseptic in solutions of 1–4000 to 1–2000. It does not blacken instruments.

Mercury Oxycyanide
(Hydrargyri Oxycyanidum)

This is used like bichloride of mercury. It has a greater antiseptic power, is less injurious to the tissues, and does not corrode instruments. It is used in 1–5000 solutions.

Mercuric Salicylate 0.003–0.008 gm. gr. $\frac{1}{20}$–$\frac{1}{8}$
(Hydrargyri Salicylas)

This preparation is now frequently used, especially for intramuscular injections. For these injections, a 10% solu-

tion in water or liquid paraffin is used, of which 0.6 c. c. (m. x) is injected deep into the gluteal muscles every fourth day.

Mercuric Succinimide 0.01–0.015 gm. gr. $\frac{1}{6}$–$\frac{1}{4}$
(Hydrargyri Succinimidum)

This is used principally for intramuscular injections. A 2½% solution is used, of which 0.5–1.0 c.c. (m. viii–xv) are injected daily.

It also comes in hypodermic tablets, each containing 0.006–0.003 (gr. $\frac{1}{10}$–$\frac{1}{20}$).

Mercurol 0.03–0.12 gm. grs. ½–ii
(Hydrargyri Nucleinas)

This is said to have a special value as an antiseptic and specific for syphilis.

Mergal one capsule 0.015 gm. grs. ¼ ii

This is a mixture of mercuric cholate and albumin tannate put up in capsules. Each capsule contains 0.05 gm. (gr. ¾) of mercuric cholate.

Mercuric Benzoate 0.015–0.03 gm. gr. ¼–½
(Hydrargyri Benzoas)

This has been used principally as a specific for syphilis and is given hypodermically.

Calomelol
Colloidal Calomel
(Hydrargyri Chloridum Mite Colloidale)

Calomelol is a preparation of calomel combined with albuminoids, and is said to act more efficiently, not to gripe as much, and to be less poisonous than calomel.

THE IODIDES

The iodides are salts formed by the action of an alkali, such as sodium, potassium or ammonium, on hydriodic acid, an acid formed from iodine; a non-metallic element, obtained from sea-weeds.

Appearance of the Patient

After a single dose of one of the iodide salts is given, ex-

cept for its slightly metallic salty taste, a slight burning pain in the stomach, and perhaps some slight nausea for a few minutes, there are no appreciable effects.

If the iodides are given continuously for some time, however, the secretions are all increased, the pulse is somewhat faster and softer, the patient passes more urine and feels much better.

When the iodide preparations are given for some time to a patient suffering from any manifestation of **syphilis,** especially of **the third stage,** these symptoms gradually disappear, and the patient feels entirely well again, in a very short time. For example, if the patient has a syphilitic ulcer in any region of the body, the ulcer gradually heals. A syphilitic paralysis when treated with an iodide preparation, soon disappears, and the patient can move the paralyzed extremity perfectly well again.

ACTION

Local action. The iodides produce no local effect when applied on the skin or mucous membranes, but they are rapidly absorbed into the blood from all mucous membranes.

Internal Action

In the mouth: The iodides have a characteristic salty metallic taste.

In the stomach: They slightly increase the secretions, and occasionally cause nausea, and slight discomfort. The intestines are not usually affected by the iodides.

Action after Absorption

The iodides are very rapidly absorbed into the blood; from the stomach, intestines, and all the mucous membranes, usually in about five minutes. After absorption, it acts principally as a specific for syphilis, and it also affects the secretions, the kidneys, newly formed tissues, and the nutrition.

Specific Action in Syphilis

The most striking effect of the iodides is noticed in pa-

tients suffering from syphilis, especially from the symptoms of the third stage. These symptoms are the result of the formation of areas of round cells (gummata) which form in various parts of the body as a result of the presence in the blood of the spirochaeta pallida. These newly formed areas of cells very soon become fluid and areas of various tissues and organs of the body are thus destroyed, thus producing various symptoms.

Very soon after the treatment with the iodides is begun in these patients, the patient feels better, the particular manifestation of syphilis from which he may be suffering, begins to improve, until finally he is entirely well again. For example, if the patient is suffering from a syphilitic ulcer in any part of the body, after treatment with iodides this ulcer heals very rapidly. A syphilitic paralysis due to the formation of a gumma in the brain or spinal cord, when treated with iodides soon disappears. The affected extremities regain their motion and the patient soon feels entirely well again. In a similar manner, a syphilitic condition of any organ of the body is relieved. **The iodides cure the third stage of syphilis,** by causing the absorption of newly formed areas of round cells, or gummata, which cause the various symptoms. It also probably destroys the spirochaetae which cause the disease.

Action on the secretions: The iodides increase the secretions of all the mucous membranes and the salivary glands. The mucous from the nose and bronchi is particularly increased, and becomes more fluid in character. The secretion of saliva, milk, and other glands are also slightly increased.

Action on the kidney: The iodides slightly increase the flow of urine.

Action on nutrition: They increase the nutrition of the tissues and hasten the excretion of waste products.

Effect on newly formed tissues: The iodides increase the absorption of newly formed connective tissue, and even old scar tissue in any organ of the body. These drugs are frequently used for these effects in arteriosclerosis (Hardening of the arteries), cirrhosis of the liver, etc.

Young connective tissue cells are small round cells which

resemble the round cells found in gummata, and they are therefore probably affected by the iodides in the same way as the gummata or round cell formations of the third stage of syphilis. Accumulations of serum in the chest (pleurisy with effusion) or in other parts of the body, is more rapidly absorbed when the iodides are given.

Action on the heart: The pulse is often faster after continued use of the iodides.

Excretion

The iodides are eliminated from the body by the urine, mainly as iodides, usually within twenty-four hours. The iodine is also separated from the iodides, and this is then excreted in all the secretions of the secretory glands and mucous membranes. The mucous of the nose and the bronchi, the saliva, milk, the hair, etc., then contain iodine, which also increases these various secretions.

Idiosyncrasies

In some individuals small doses often cause poisonous effects.

Poisonous Effects

The iodides do not cause acute poisoning. Since they are excreted more slowly than they are absorbed, however, chronic poisoning or **iodism** frequently results from the accumulation of some of the drug in the body after prolonged administration. These cumulative symptoms occasionally result in some individuals from very small doses.

The symptoms of iodism are due to the excretion of the iodine by the various mucous membranes, and they are not so apt to occur in syphilitic patients.

Cumulative Symptoms or "Iodism"

The first symptom of excessive iodide action is:

1. **Profuse secretion of mucus from the nose** (coryza) and sneezing.

These are soon followed by:

2. Red, swollen eyelids with excessive flow of tears.

3. **Frontal headache.**
4. Cough, with profuse expectoration of mucous.
5. Increased flow of saliva.
6. Sore throat and difficulty in swallowing.
7. **Skin eruptions,** such as areas of redness, or small pustules on the face, back, shoulders or thigh (acne). Occasionally eczema occurs.
8. The pulse is often rapid and a slight rise in temperature may occur.
9. Nausea, and diarrhoea occasionally occur.
10. Weakness, loss of weight, and pains in the joints occasionally result from continued use.

Treatment

When the iodides are stopped, the symptoms usually disappear.

Uses

The iodides are used principally:

1. **As a specific for the third stage of syphilis.** In syphilis, the treatment must be continued for about three years; even if the patient has no symptoms, to eradicate all the poison from the body.
2. They are also frequently used to absorb connective tissue in various chronic diseases characterized by the formation of connective tissue in various organs and tissues of the body. For example, in **arteriosclerosis** (thickening of the blood vessels by the formation of connective tissue in their walls), **cirrhosis of the liver,** or the formation of connective tissue in the liver, **chronic nephritis** or the formation of connective tissue in the kidneys, etc.
3. To increase the absorption of inflammatory swellings of the glands and other tissues, and to absorb fluids in the chest.
4. To increase the secretions of the mucous membranes, such as the bronchi, the nose, etc.

Administration

The iodides are best given before meals; in milk, wine,

aromatic spirits of ammonia, or the compound spirits of sarsaparilla, or cinnamon water, to disguise the unpleasant taste. It is occasionally given in pills or capsules.

Preparations

Potassium Iodide (Potassii Iodidum) — 0.3–1.0 gm. grs. v–xv. In syphilis it may be given up to 4.0 gms. (ʒi)

This is the most efficient and most commonly used preparation. It often comes in 50% or saturated (100%) solutions.

Sodium Iodide (Sodii Iodidum) — 0.12–1.3 gm. grs. ii–xx

Ammonium Iodide (Ammonii Iodidum) — 0.12–1.0 gm. grs. ii–xv

Strontium Iodide (Strontii Iodidum) — 0.3–1.0 gm. grs. v–xv

Dilute Hydriodic Acid (Acidum Hydriodicum Dilutum) — 0.3–0.6 c.c. m. v–x

This contains 10% of hydriodic acid.

Syrup of Hydriodic Acid (Syrupus Acidi Hydriodici) — 2.0–8.0 c.c. ʒ½–ii

This contains 1% of hydriodic acid.

For Local Use

Potassium Iodide Ointment (Unguentum Potassii Iodidi)

New and Non-official Preparations

Sajodin — 1.0–3.0 gms. grs. xv–xlv

This acts like potassium iodide, but is said not to produce the symptoms of iodism.

Ferro Sajodin — 1–2 tablets

This contains 5% of iron and 24% of iodine. It comes in tablets, each containing 0.5 gm. (grs. viii) of ferro sajodin.

Iodo Casein — 0.3–1.3 gm. grs. v–xx

It is digested in the intestine where it is rapidly absorbed,

then acting like the iodides. It does not disturb digestion as much as the other iodides.

Iodalbin 0.3–0.6 gm. grs. v–x

This is a compound of iodine and albumin from blood. It is absorbed from the intestines, and it then acts like the other iodides.

Iodipin 0.2–0.6 gm. grs. ii–x

This is a compound of iodine and sesame oil. It acts like the other iodides, but its effects are more lasting, and they are said not to cause iodism. It is given hypodermically. It usually comes in 10 or 25% solutions or in capsules, each containing 2.0 gms. (grs. xxx).

Iothion

This acts like the iodides or iodine, and is readily absorbed from the skin. It is applied in a 25 to 50% ointment like mercury ointment.

SALVARSAN

Salvarsan, arsenobenzol, or "606" is a complex organic arsenic salt. It is a yellow powder which comes in a sealed glass tube together with nitrogen gas.

ACTION

Salvarsan is a specific against all stages of syphilis. It cures this disease by destroying the organism which causes syphilis; the spirochaeta pallida, and its poisons. The results obtained from the use of salvarsan are very remarkable; the symptoms often clearing up entirely in a few weeks.

Since this treatment has only been used for a few years, however, and, as the symptoms of the third stage of syphilis often return as long as twenty years after the infection, it is impossible to state at the present time whether the cure is permanent or not.

The treatment with salvarsan is frequently repeated a number of times, and is usually followed by the usual treatment with mercury and iodides.

Salvarsan has also been used with success in the treatment of malaria, and other infectious diseases resulting from the

circulation in the blood of a parasitic organism, such as the organism of **relapsing fever, frambesia,** etc.

Symptoms of arsenic poisoning occasionally result from the use of salvarsan.

Administration

Salvarsan is usually given by direct injection into the veins, like an intravenous infusion. The remedy must be very carefully neutralized with an alkali, such as potassium hydroxide, and then dissolved in about 250–300 c.c. of sterile, distilled water, and the resulting solution is then allowed to slowly run into the veins.

Salvarsan is also given by deep injections into the muscles.

Preparations

Salvarsan or " 606 "	0.3–0.6 gm.	grs. v–x
Arsenphenol-amin hydrochloride (Arsenobenzol)		

This contains about 31% of arsenic.

Neosalvarsan	0.6–0.9 gm.	grs. x–xiv

Neosalvarsan is only half as strong as salvarsan. It has the advantage that it does not have to be neutralized with an alkali. It is dissolved in sterile, distilled water; about 25 c.c. being used for every 0.1 gm. of neosalvarsan.

It is given like salvarsan, by injection into the veins (intravenously), or it is injected into the muscles (intramuscularly).

SALICYLIC ACID AND THE SALICYLATES

Salicylic acid is a white crystalline powder which is made chemically by the action of sodium hydroxide (caustic soda) and carbonic acid, on carbolic acid.

The **salicylates** are salts formed by the combination of an alkali, such as sodium, with salicylic acid; sodium salicylate being thus formed. Various other salts are made in a similar way, by the combination of an organic chemical substance such as methyl alcohol with salicylic acid, **methyl salicylate** then being formed.

Many of these salts are found in various plants. For example, methyl salicylate is found in the **oil of wintergreen, or oleum gualtheriae,** and in the **oil of sweet birch, oleum betulae.**

There are many new preparations which are made chemically from salicylic acid or its salts. Many of these are extensively used.

Appearance of the Patient

About 15 minutes after an average dose of salicylic acid, or one of the salicylates is given, the patient complains of a slight burning pain in the pit of the stomach, and possibly of a slight feeling of fullness in the head. Soon the patient sweats profusely, and the temperature is lowered 1 or 2 degrees, particularly if there is fever. The pulse is somewhat faster and stronger, unless the dose given has been quite large, but it may be slower and weaker. The breathing is usually somewhat faster, and the patient passes more urine.

If the patient is suffering from acute articular rheumatism, the pains and swellings around the joints are gradually relieved.

ACTION

Local action: Salicylic acid and the salicylates are antiseptics. They soften the epidermis or hard layer of the skin when directly applied to the surface. **On mucous membranes,** they cause redness and increased secretions (irritation).

Internal Action

In the mouth: They have a peculiar salty sour taste.

In the stomach: Salicylic acid and the salicylates increase the secretions, but they lessen digestion, by diminishing the activity of the digestive ferments, such as pepsin. If given on an empty stomach, they are apt to cause burning pain in the stomach, occasionally nausea, and possibly vomiting.

In the intestines: They have an antiseptic action, checking the growth of bacteria. At the same time, they increase the secretions and lessen digestion.

Action after Absorption

Salicylic acid and the salicylates are rapidly absorbed in the stomach and intestines, usually in about 15 minutes. After absorption, they affect the circulation, the respiration, the sweat glands, the kidneys, the temperature and they affect particularly acute articular rheumatism.

Action on the circulation: The salicylates usually make the pulse somewhat faster and stronger at first, by increasing the contractions of the heart muscles and contracting the blood vessels.

With larger doses, the contractions of the heart muscle are soon weakened and the pulse becomes slower and weaker.

The blood vessels of the skin are usually dilated, so that the skin is flushed.

Action on the respiration: The breathing is usually somewhat faster and deeper after salicylates, occasionally the patient is somewhat short of breath (dyspnoeic).

Action on the secretions: The salicylates increase particularly the secretion of sweat. The patient is usually covered with profuse perspiration, about fifteen minutes to a half hour after a dose of one of the salicylates is given. They are also said to increase the flow of bile.

Action on the kidneys: The salicylates increase the secretion of urine; they also act as an antiseptic along the urinary organs, and make the urine more acid in reaction. The urine occasionally contains albumin.

Effect on temperature: The salicylates reduce the temperature several degrees in fevers, because of the increased elimination of heat which results from the profuse sweating and dilated blood vessels of the skin. The temperature begins to go down in fifteen minutes, and stays down for about six hours. The normal temperature is not affected however.

Specific Action in Rheumatism

Salicylic acid and the salicylates are used principally as specifics for acute articular rheumatism.

Acute articular rheumatism is a disease characterized by pain, redness and swelling of the various joints of the body,

associated with high temperature. The disease begins in one joint, and then affects many of the others. The cause of this disease is unknown, though it is probably an infectious disease.

Effect of Salicylates

When any of the salicylates are given regularly for some time, to a patient suffering with acute articular rheumatism, the pains become lessened in a few days, the redness and swelling of the joints are diminished, the temperature subsides, and the patient soon gets well.

The mode of its action is unknown. Many cases, however, are improved better by some preparations of the salicylates than by others, and some cases are not improved at all by any of them. Chronic rheumatism, however, does not respond so readily to treatment with the salicylates.

Excretion

The salicylates are eliminated from the body as **salicyluric acid,** mainly by the urine, usually in several hours. Some of the drug is also excreted in the perspiration, milk and bile.

Poisonous Effects

Large doses of salicylates often cause quite alarming symptoms, especially if used for a long time, but they are rarely fatal. The symptoms resemble those of quinine poisoning.

Symptoms

The first symptom of an overdose of salicylates is:

1. **Buzzing and noises in the ears,** and a feeling of fullness in the head. These are soon followed by:
2. **Deafness.**
3. Dimness of vision.
4. **Profuse perspiration.**
5. Feeling of warmth all over the body.
6. **Occasionally nausea and vomiting.**

In severe cases besides these symptoms there are usually:

7. Dyspnoea, rapid, irregular, deep and labored breathing.

8. Collapse (slow, weak pulse, subnormal temperature, cold moist skin, etc.).

9. Unconsciousness.

10. Occasionally the patient becomes delirious or even maniacal, and he often seems to see various objects about him (hallucinations of sight) or he may hear voices about him (hallucinations of hearing).

Death has rarely resulted from salicylate poisoning.

Treatment

1. If the drug is stopped, the symptoms usually disappear in a few days or a week.

2. Caffeine, strychnine, or other heart stimulants should be given, if the pulse is weak.

Administration

Salicylic acid or the salicylates, are best given in capsules, tablets or in syrup, about an hour or two after meals. They will not then interfere with digestion, and are not so apt to cause nausea and pain in the stomach.

Preparations

Salicylic Acid (**Acidum Salicylicum**)	0.3–2.0 gms.	grs. v–xxx

This is more readily dissolved in hot water or in a solution of boric acid or borax.

Sodium Salicylate (**Sodii Salicylas**)	0.3–2.0 gms.	grs. v–xxx

This is more soluble than the salicylic acid and is not so apt to upset the stomach.

Lithium Salicylate (**Lithii Salicylas**)	0.3–2.0 gms.	grs. v–xxx
Ammonium Salicylate (**Ammonii Salicylas**)	0.3– gm.	grs. v
Strontium Salicylate (**Strontii Salicylas**)	1.0– gm.	grs. xv
Oil of Wintergreen (**Oleum Gaultheriae**)	0.3–1.0 c.c.	m. v–xv

This is a volatile oil obtained by distilling **Gaultheria procumbens** or wintergreen. It contains 90% of methyl salicylate and is given in emulsion or capsules. It acts like the salicylates, but it occasionally causes nausea and vomiting.

Oil of Sweet Birch (Oleum Betulae) 0.3–1.0 c.c. m. v–xv

This is made by distilling the bark of **Betula lenta** or birch bark.

Methyl Salicylate (Methylis Salicylas) 0.3–1.0 gm. grs. v–xv

This is artificial oil of wintergreen. It is contained in oil of wintergreen and oil of sweet birch.

Salicin (Salicinum) 0.3–2.0 gms. grs. v–xxx

Salicin is a glucoside obtained from the bark of various species of willow and poplar trees. It is changed to salicylic acid in the body and it then produces the same effects.

It has a very bitter taste and is not as reliable in its action as the other preparations.

Salol (Phenylis Salicylas) 0.3–2.0 gms. grs. v–xxx

Salol is a tasteless powder which is decomposed by the steapsin of the pancreatic juice in the intestine into salicylic and carbolic acids. The salicylic acid is absorbed into the blood from the intestines, and it then produces the same effects as salicylic acid.

Salol is frequently used as an intestinal and urinary antiseptic. Symptoms of carbolic acid poisoning frequently result from the carbolic acid which it forms in the intestines.

For Local Use

Boro Salicyl Solution
(Thiersch Solution)

This is a solution made by dissolving a Thiersch powder in 1000 c.c. or a quart of water.

Each Thiersch powder contains:

TABLE OF COMPARATIVE ACTION OF SALICYLATES

Name of Drug	Local Action	Antiseptic Action	Effect on Stomach	Rate of Absorption	Effect on Sweat Glands	Effect on Temperature	Poisonous Effects
Salicylic acid.	Softens skin.	Local intestinal and urinary antiseptic.	Occasional nausea.	Rapid.	Profuse perspiration.	Lowered.	Slow weak pulse, ringing in the ears, etc.
Sodium Salicylate Strontium and Lithium salicylates.	Does not soften skin.	No local antiseptic action but is a urinary and intestinal antiseptic.	Nausea less common.	Rapid.	Same.	Same.	Same.
Methyl salicylate and Oil of wintergreen.	No effect on skin.	Same.	More nausea.	Same.	Same.	Same.	Same.
Salol.	Same.	Same.	No effect in the stomach.	Slowly absorbed in the intestine forms carbolic and salicylic acid.	Same.	Same.	Carbolic acid poisoning occasionally.
Salicin.	Same.	Slight intestinal and urinary antiseptic.	Same.	Slowly absorbed in intestine. Effect slow and not as reliable.	Same.	Same.	Poisoning rare, slow pulse ringing in the ears.
Aspirin Novaspirin and newer drugs.	Same.	Intestinal antiseptic.	Occasional burning pain and nausea.	Slow absorption.	Same.	Same.	Poisonous effects are occasional slow pulse.

Boric Acid	15.0–30.0 gms.	ʒ½–i
Salicylic Acid	2.0– 4.0 gms.	3½–i

Thiersch solution is used as an antiseptic dressing, and is particularly valuable to soften the skin.

Salicylic Acid Ointments:

These usually contain from 2 to 20% of salicylic acid and are principally used to soften and remove corns. Many corn salves and plasters consist principally of salicylic acid.

New and Non-official Preparations

Aspirin 0.3–1.0 gm. grs. v–xv
(Acidum Acetylsalicylicum)

This is a compound made chemically from salicylic acid. It is absorbed in the intestines and then acts like salicylic acid, but because it is very slowly absorbed, its effects are more lasting. It is not so apt to cause poisonous effects.

Novaspirin 0.3–1.0 gm. grs. v–xv
(Methylene Citrylsalicylic Acid)

It acts like aspirin but is said not to upset the stomach.

Diaspirin 1.0 gm. grs. xv
Succinyl Disalicylic Acid

Ethyl Salicylate 0.3–0.6 c.c. m. v–x
(Aethylis Salicylas)
(Sal Ethyl)

This is similar to methyl salicylate, and is said not to cause poisonous symptoms.

Mesotan or Ericin

This is an oily fluid made from salicylic acid (methyl oxymethyl salicylate). It acts like the oil of wintergreen and is applied to the skin in an equal part of olive oil.

Salophen 0.3–1.0 gm. grs. v–xv

This resembles salol in its action. It is changed in the intestines to **salicylic acid,** and **acetylparamidophenol,** which is not poisonous. It is therefore safer than salol.

Saloquinine 0.5–2.0 gms. grs. viii–xxx

This is a compound of quinine and salicylic acid; quinine salicylate. It combines the action of both.

Saloquinine Salicylate 1.0 gm. grs. xv

This acts like saloquinine.

Spirosal
Monoglycol Salicylate

This is absorbed from the skin and acts like salicylic acid which it forms in the body. It is applied on the skin in three parts of alcohol or in eight parts of olive oil.

Betol or Naphthol
Naphtholis Salicylas
Cresol (official)
Thymosalol
} These are preparations which act like salol.

Antipyrine salicylate, phenocoll salicylate, saliphen, malakine, are used mostly to reduce fever, though they also act like salicylic acid which they form in the body. (See antipyretics.) See also Table, page 500.

COLCHICUM (MEADOW SAFFRON)

Colchicum is obtained from the seeds, **Colchici semen** and underground stems, **Colchici cormus,** of the meadow saffron or **Colchicum autumnale,** a small plant growing in Europe and England. The active principle is a substance called **colchicine.**

Appearance of the Patient

An ordinary dose of colchicum causes very little effect, but several hours after a moderate dose is given, the patient complains of some abdominal pain, perhaps of a little nausea, and later he has frequent movements of the bowels and the urine may be somewhat increased. The pulse may be a little slower and occasionally the tears, saliva and sweat are somewhat increased.

If the patient is suffering from an attack of acute gout, the severe pains of this condition are usually relieved.

ACTION

Local action: Applied to the skin or mucous membranes,

it causes redness, burning pains and swelling, with increased secretions of the mucous membranes.

Internal Action

In the mouth: Colchicum causes burning pains. It increases the secretion of saliva and also causes pain in the throat.

In the stomach and intestines: It increases the secretions and peristalsis, occasionally causing nausea and frequent movements of the bowels. It often causes cramp-like abdominal pains.

Action after Absorption

Colchicum is very slowly absorbed from the stomach and intestines, usually in about several hours. After absorption it affects particularly the pains of acute gout and the kidneys.

Action in Gout

Acute gout is a disease characterized by severe pain, redness and swelling of one or more joints of the body. The joints of the toes and hands are particularly affected, and the pains more often occur at night. The disease is said to be due to the deposit in the joints, of crystals of uric acid, one of the constituents of the urine.

Colchicum relieves particularly the pains of acute gout, though it is not really a specific for that disease.

Action on the kidney: Colchicum increases the secretion of urine. It is said to increase the amount of uric acid and urea in the urine.

Action on the secretions: Large doses of colchicum increase the secretions of saliva, tears, mucus from the nose and from all the other mucous membranes. Large doses occasionally make the pulse and breathing somewhat slower.

Excretion

Colchicum is eliminated from the body in a few hours; by the kidney, the stomach and intestines.

Poisonous Effects

Colchicum is a very violent poison; small doses having

caused death. An overdose of colchicum usually causes the following symptoms within a few hours:

1. Severe abdominal pain.

2. Nausea, and continual profuse vomiting which is accompanied by profuse secretion of saliva, tears and mucus from the nose.

3. Profuse diarrhoea.

The vomited matter and stools contain mucus and serum at first, but later they often contain blood.

4. Scanty and bloody urine, or there may be no urine secreted at all. Occasionally the urine may be increased.

5. Spasms of the muscles, even convulsions followed by great muscular weakness, with slow movements and paralysis.

6. Collapse (rapid, thready pulse, slow and shallow breathing, cold moist skin).

Death soon results from respiratory paralysis.

Treatment

1. Give tannic acid preparations, to neutralize the colchicum.

2. Wash out the stomach.

3. Protect the mucous membrane by white of egg, milk, etc. (demulcents).

4. Keep the patient quiet.

5. Treat the collapse with heart stimulants, such as caffeine, strychnine, etc.

Uses

Colchicum is used principally to relieve the pains of acute gout. It is also given together with potassium iodide in chronic rheumatism.

Preparations

Colchicum Stems

Extract of Colchicum Stems (Extractum Colchici Cormi)	0.03–0.12 gm.	grs. ½–ii

Colchicum Seeds

The preparations of the seeds are principally used.

Wine of Colchicum Seeds (Vinum Colchici Seminis)	0.6–4.0 c.c.	m. x–ʒi

This contains 10% of colchicum and is the preparation commonly used.

Fluidextract of Colchicum Seeds (Fluidextractum Colchici Seminis)	0.1–0.3 c.c.	m. ii–v
Tincture of Colchicum Seeds (Tinctura Colchici Seminis)	0.3–1.0 c.c.	m. v–xv
Colchicine (the active principle)	0.0005 gm.	gr. $\frac{1}{120}$

PIPERAZINE (not official)

Piperazine is a chemical substance which is frequently used to relieve gout, and to dissolve stones in the kidney and bladder. Its use is based upon the fact that it dissolves uric acid crystals, when added to them in a test tube. Practical experience in the use of this drug has not borne out this effect on the patient. It slightly increases the flow of urine, however.

Preparations

Piperazine (Piperazina)	0.3–0.6 gm.	grs. v–x
Lycetol Dimethyl Piperazine Tartarate	1.0–2.0 gms.	grs. xv–xxx
Sidonal or Piperazine Quinnate (Piperazinae Quinnas)	1.0–1.3 gm.	grs. xv–xx

ATOPHAN (not official)

Atophan or **phenylquinolin carboxylic acid,** is a white, crystalline substance which is made chemically from various other complex substances.

ACTION

Atophan has a specific action in acute gout. **It relieves the pains around the joints very promptly.** It increases the secretion of urine and the amount of uric acid contained in it. Beneficial effects have also been obtained from its use in other chronic joint affections, such as rheumatism, etc.

It is not a poisonous drug, and is therefore safer than colchicum.

Preparations

Atophan	0.5–1.0 gm.	grs. viii–xv
Phenyl-quinolin Carboxylic Acid		
Novatophan	0.5–1.0 gm.	grs. viii–xv
Paratophan	0.5–1.0 gm.	grs. viii–xv

ANTHELMINTICS

Anthelmintics are drugs which are principally used to destroy or expel intestinal worms. The drugs which destroy these worms are often called **vermicides,** and those which expel them, **vermifuges.** This difference in their action really depends however, upon the amount of the drug that is given, and how soon afterwards the bowels are moved. Thus, a large dose of one of the anthelmintics, if it remains in the intestine, will destroy the worm, while a smaller dose merely expels it.

With the exception of pelletierine, which has a specific action on tape worms, most of these drugs do not affect the worms themselves.

All the anthelmintics are poisonous both to the worm and to the patient, but they are very slowly absorbed, so that their poisonous action is manifested mainly on the worm. Occasionally, if these drugs are not followed by a cathartic, they may be absorbed, and poisonous symptoms then result.

The anthelmintics are best classified according to the particular worm for which they are used.

The most common worms which are found in the intestines are:

1. **Tape Worms, or Taeniae.**
2. **Round Worms, or Lumbrici.**
3. **Thread Worms, Seat Worms or Ascarides.**
4. **Hook Worms, or Uncinariae.**

The diagnosis of the form of worm is usually made by finding the particular eggs in the stools.

Administration

In giving any of the anthelmintics, it is important that the following routine measures be carefully carried out.

1. The patient should be given a very light diet, a day or two before the drug is administered, or better still, no food should be given for twenty-four hours before.

2. The bowels should be thoroughly moved with a light laxative, the day before administration.

3. The drug should best be given early in the morning on an empty stomach.

4. About four to eight hours after the drug has been given, a brisk cathartic such as calomel, or castor oil, should be given, to expel the worm. Occasionally a cathartic like calomel is given together with the drug. It is best not to give the patient any food until the bowels move.

TAENICIDES

Taenicides are drugs which destroy or remove tape worms.

Tape worms are long flat worms which consist of many segments. They often inhabit the intestine as a result of eating meat or pork infected with their eggs.

MALE FERN (ASPIDIUM FILIX MAS)

Male fern or filix mas is obtained from the underground stems of the **Dryopteris filix mas** and of **Dryopteris marginalis,** European ferns.

The active principles of these plants are a number of neutral and acid substances; **aspidin** and numerous other similar substances, though **filicic acid** was formerly supposed to be the active principle.

ACTION

When taken internally, male fern has a very unpleasant, nauseous taste, and **it destroys tape worms and hook worms.**

Poisonous Effects

In some individuals, if large doses of the drug are given, it may be absorbed and cause:

1. Abdominal pain.
2. Nausea, vomiting and diarrhoea.
3. Muscular twitchings.
4. Convulsions, collapse, coma, and death.

Administration

The oleoresin or liquid extract is usually given, either in pills, capsules or suspended in mucilage.

Preparations

Oleoresin of Aspidium (Oleoresina Aspidii)	2.0–8.0 c.c.	ʒ½–ii

New and Non-official Preparations

Filicic Acid Amorphous (Acidum Filicicum Amorphum)	0.5–1.0 gm.	grs. viii–xv
Filmaron	10 c.c.	ʒii½

This is a substance obtained from an ethereal extract of aspidium. It is said to be safer than aspidium.

This is a 10% solution of filmaron in castor oil.

CUSSO

Cusso, kousso or brayera, are the female flowers of **Hagenia abyssinica** or **Brayera anthelmintica,** an Abyssinian tree. Its active principle is a neutral resin, **kosotoxin,** but it also contains tannic acid, a volatile oil and other substances.

ACTION

Cusso has a bitter taste and contracts mucous membranes. Its principal effect is to destroy tape worms.

Large doses occasionally cause nausea, vomiting, diarrhoea and rarely, collapse with an irregular pulse.

Preparations

Cusso is usually given by suspending 15.0 gms. (ʒ½) of the powdered flowers in water.

Fluidextract of Cusso (not official) **(Fluidextractum Cusso)**	8.0–16.0 c.c.	ʒi–iv

No cathartic is required after cusso, though the usual preparatory methods should be carried out.

GRANATUM (POMEGRANATE)

Granatum is the bark of the stem and root of **Punica granatum** or pomegranate. Its active principles are the alkaloids, **pelletierine** or **punicine**, and **isopunicine**, and it also contains a large amount of tannic acid.

ACTION

Granatum and its alkaloids, have a specific destructive action on tape worms. It has a very unpleasant taste and is not a safe drug to use.

Poisonous Effects

Overdoses of pelletierine or granatum, paralyze the nerve endings of the muscles, causing effects like those of curara poisoning.

Symptoms

1. Mental dullness and confusion of ideas.
2. Dizziness.
3. Great weakness of the limbs, even paralyses.
4. Dimness of vision.
5. Occasionally nausea, abdominal pain, perhaps vomiting and tremors of the muscles of the legs.

Administration

Granatum is usually given as a decoction made from about 30.0–60.0 gms. (℥i–ii) of fresh bark, in about 250.0 c.c. (½ pt.) of water. The drug is then given in two parts at intervals of an hour each, and the last dose should be followed in a half to two hours by a cathartic.

Preparations

Fluidextract of Pomegranate (Fluidextractum Granati)	2.0 c.c.	m. xxx
Pelletierine Tannate (Pelletierinae Tannas)	0.25 gm.	grs. iv

This is a mixture of all the alkaloids of pomegranate bark.

PEPO (PUMPKIN SEED)

Pepo is the ripe seed of **Cucurbita pepo** or the ordinary pumpkin. Its active principle is a fixed oil and a resin.

ACTION

Pumpkin seeds are a very efficient and harmless remedy for tape worms.

Administration

The patient should fast the day before the drug is to be given, and the following morning, about two to four ounces of the seeds, beaten up in an emulsion of sugar and water, or honey, should be given. Occasionally, 15.0 gms. (℥½) of the expressed oil is given. It should always be followed by a cathartic several hours later.

Preparations

Pepo or **Pumpkin Seeds**	60.0–120.0 gms.	℥ii–iv

KAMALA

Kamala is a reddish brown powder consisting of the minute glands and hairs from the capsules of **Mallotus philippensis,** an East Indian shrub. Its active principles are two resinoid substances, **kamalin** and **rottlerin.**

ACTION

Kamala destroys the tape worms and causes profuse diarrhoea so that no cathartic is necessary after its use.

Preparations

About 4.0–8.0 gms. (℥i–ii) of the powder is given in syrup, and repeated in two hours if the bowels do not move. **A tincture of kamala** is also occasionally given.

TURPENTINE

Turpentine destroys tape worms and round worms. It is given in doses of 30.0 gms. (℥i) with twice its amount of

castor oil. It is also given in very small doses, together with other anthelmintics. It is very apt to cause poisonous symptoms and is therefore not frequently used.

LUMBRICIDES

Lumbricides are drugs which destroy round worms. Round worms are small cylindrical worms which are often found in the small intestine of children.

SANTONICA (LEVANT WORM SEED)

Santonica or levant worm seed is the dry unopened flower heads of the **Artemisia pauciflora,** a plant growing in Asia Minor. Its active principle is a crystalline substance called **santonin,** though it also contains a similar substance called artemisin and a volatile oil, cineol.

ACTION

Santonin has a bitter taste and is partly dissolved in the stomach. Here some of it is absorbed into the blood. Most of the santonin then passes out into the small intestine, where **it destroys round worms, or ascaris lumbricoides.**

Action after Absorption

The absorption of some of the santonin, causes in many cases, a very characteristic and peculiar disturbance of vision known as **xanthopsia,** or **" yellow vision."**

At first all objects seem to have a blue color, but this effect lasts for a very short time, and is soon followed by a condition where **all objects seem to have a yellow tint;** thus, blue seems green; and violet cannot be seen at all. This condition lasts for several hours and is probably due to a direct poisonous effect on the retina of the eye. Occasionally there are also disturbances of the sense of taste, smell, and hearing.

Santonin is excreted by the urine, to which it gives a characteristic yellow or reddish color.

Poisonous Effects

Overdoses of santonin not infrequently cause poisonous symptoms, especially in children.

Symptoms

1. "Yellow vision."
2. Twitchings of the muscles of the head.
3. Rolling of the eyes, and grinding of the teeth.
4. Various movements of the head, forward and backward, and from side to side. These symptoms are soon followed by:
5. Convulsions.
6. Slow, irregular breathing, especially during the convulsions.
7. Collapse (slow, weak pulse, moist cold skin, dilated pupils, etc.).
8. Occasionally nausea and vomiting, or loss of speech (aphasia), occur.

Treatment

Wash out the stomach, give emetics and cathartics, and treat the convulsions with chloroform or ether.

Preparations

Santonin, the active principle, is the drug which is principally used.

Santonin (Santoninum) 0.03–0.3 gm. grs. ½–v

For a child 2 years old 0.015 gm. (gr. ¼) should be given.

Troches of Santonin (Trochisci Santoninae) 1–5

For a child, only 1 should be given.
Each contains 0.03 gm. (gr. ½) of santonin.

SPIGELIA (PINK ROOT)

Spigelia or pink root is the root of the **Spigelia marilandica,** or carolina pink, a plant growing in the southern United States.

ACTION

Spigelia is used to remove round worms. As it does not destroy the worm, it must be followed by a brisk cathartic.

Poisonous Effects

Overdoses of spigelia have occasionally produced the following symptoms, especially in children.

1. Dry, flushed skin.
2. Puffiness and swelling of the face.
3. Rapid pulse, delirium and stupor.
4. Dimness of vision or temporary blindness.

Preparations

Fluidextract of Spigelia (Fluidextractum Spigeliae)	4.0–8.0 c.c.	ʒi–ii

For a child, 0.6 c.c (m. x) is given on a piece of sugar. This is often given together with senna.

AZEDARACH

Azedarach is the bark of the root of **Melia azedarach,** or the pride of China, an Eastern plant.

It is used in the South as a remedy for round worms. It is usually given as a decoction, made from ʒii of the plant to a half pint of water, of which 15.0 c.c. or half ounce is given every two hours. It is said to produce the same poisonous effects as spigelia.

CHENOPODIUM (not official)

Chenopodium or American worm seed, is the fruit of the **Chenopodium ambrosioides,** or Jerusalem oak, an American plant. Its active principle is a volatile oil, which has an extremely rank odor.

ACTION

It is used principally to destroy round worms, and should always be followed by a brisk cathartic.

Preparations

Oil of Chenopodium (Oleum Chenopodii)	0.2–0.3 c.c.	m. iii–v

It is usually given on sugar or in an emulsion.

Senna and **Calomel** are also frequently used to remove round worms.

DRUGS WHICH DESTROY THREAD WORMS

Thread worms are small cylindrical worms which often inhabit the large intestine. The patients suffering from these worms are usually treated by enemata of the following substances.

1. **Quassia**
2. **Alum**
3. **Sodium Chloride**
4. **Tannic Acid**
5. **Calumba**
6. **Lime Water**
7. **Vinegar**

DRUGS WHICH DESTROY HOOK WORMS

Hook worms, **uncinaria americana,** or **anchylostoma duodenale,** are small cylindrical worms which frequently inhabit the small intestine or duodenum.

Many people in the Southern United States, Switzerland and Egypt suffer from these worms, which cause a very severe form of anaemia.

The following drugs are used to destroy hook worms.

THYMOL

Thymol is a chemical substance which resembles carbolic acid or phenol, chemically. It is principally used as an antiseptic, but it also has a specific destructive action on hook worms.

Administration

The bowels are thoroughly moved with a brisk cathartic

the day before, and the morning before administration, about 0.3–1.0 gm. (gr. v–xv) of thymol is given, and the dose is then repeated several times. About half an hour after the last dose, a dose of castor oil should be given.

Calomel, naphthol and **magnesium sulphate** are also frequently used to destroy hook worms.

PART V—DRUGS ACTING CHEMICALLY

Drugs Which Produce Effects Merely by the Chemical Combinations Which They Form in the Body

CHAPTER XX

ACIDS AND ALKALIES

ACIDS

Acids are very sour substances, either fluid or solid, which consist of several chemical elements combined with hydrogen. The hydrogen can be replaced by an alkali, thus forming a salt.

The acids are divided into two groups; **inorganic or mineral acids,** and **vegetable or organic acids.**

The vegetable or organic acids contain carbon as one of its elements, while the inorganic or mineral acids contain no carbon.

Most of the acids are very poisonous substances and are only used in very dilute solutions.

INORGANIC OR MINERAL ACIDS

The mineral acids which are principally used, are hydrochloric, sulphuric, nitric, nitrohydrochloric, and phosphoric acids. The inorganic acids produce practically the same effects with only slight individual differences.

ACTION

Local action: Applied to the skin, or mucous membranes, concentrated solutions of acids are very injurious to the tissues, and destroy the skin, mucous membranes and underlying tissues.

The tissues become shrunken, hard and brittle, because

the acids withdraw water from the tissues with which they come in contact.

Dilute solutions of the acids usually **contract mucous membranes.**

Internal Action

In the mouth: The dilute solutions which are principally used, have a characteristic sour taste and relieve thirst. They increase the flow of saliva and contract the mucous membrane of the mouth.

In the stomach: The acids aid the digestion of proteid or albuminous food, since the pepsin acts only in the presence of an acid, particularly hydrochloric acid. They slightly check the secretions of the mucous membranes, however, and are slightly antiseptic.

In the intestines: If the acid enters the intestines, it is immediately neutralized by the alkaline juices which are always present there. Salts are thus formed, and at the same time the pylorus of the stomach immediately closes, to prevent more acid from entering the intestines. In a reflex manner, the acids increase the secretions of the pancreatic juice.

Action after Absorption

The acids are rapidly absorbed from the stomach, where they combine with the alkalis of the tissues to form salts; in which form they are absorbed into the blood. They then produce no effects, except to make the blood somewhat less alkaline in reaction.

Excretion

The acids are eliminated from the body by the urine, as acid salts; the alkalis of the salts being kept back in the blood. The urine is therefore more acid in character, and often slightly injures the kidney, and the urine may then contain albumin or blood. The patient may also have burning pain in the bladder when the urine is passed.

Poisonous Effects

Acute acid poisoning usually results from an acid taken

with suicidal intent. The poisonous effects of all the acids are the same, except that hydrochloric and nitric acids make the tissues yellow and hard, while sulphuric acid turns the tissues white in color and then brown.

Symptoms

1. **Severe burning pain in the mouth, throat and stomach.** The tissues about the mouth are dry, shrunken, white or yellow in color.

2. **Profuse vomiting.** The vomited matter contains blood and pieces of mucous membrane.

3. **Profuse diarrhoea,** the stools containing blood and pieces of mucous membrane.

As a result of the destruction of the mucous membrane of the stomach and intestines, the patient suffers from;

4. **Profound collapse** (rapid, thready, weak pulse, slow, shallow breathing, subnormal temperature). Death usually occurs in several hours.

Occasionally the fumes of the acid may cause swelling of the larynx (oedema of the glottis), and the patient may then die of asphyxia.

If the patient recovers, he may suffer from various symptoms produced by the narrowing (stenosis) of the oesophagus, because of the scar tissue formed by the healing of the wound.

Treatment

1. Neutralize the acid with an alkali; such as **magnesia, or magnesium carbonate, sodium bicarbonate, or lime water.** If these substances cannot be obtained, chalk, plaster from the wall, soap suds, etc. may be used, and the acid should be well diluted by giving plenty of water.

2. Protect the mucous membranes of the oesophagus and stomach by white of egg, milk, flour and water, etc.

3. Treat the collapse with heart stimulants, such as caffeine, strychnine, atropine, etc., and keep the patient quiet.

Do not wash out the stomach, as the stomach tube may pass through the injured stomach wall.

Administration

All the acids should be given before meals, well diluted, sipped very slowly through a glass tube, so as not to injure the teeth.

PREPARATIONS OF THE MINERAL ACIDS

DILUTE HYDROCHLORIC ACID

Dilute hydrochloric acid is used principally to aid digestion in cases where there is an insufficient amount of hydrochloric acid secreted in the stomach; so that the pepsin is unable to digest the food. For example, in such diseases as chronic gastritis, or in infectious diseases.

It is also used to lessen thirst, especially in fevers, and to check intestinal putrefaction and diarrhoea.

Preparations

Dilute Hydrochloric Acid 0.3–2.0 c.c. m. v–xxx
(Acidum Hydrochloricum Dilutum)

It contains 10% of hydrochloric acid.

For local use

Hydrochloric Acid
(Acidum Hydrochloricum)

This contains 31% of hydrochloric acid.

Oxyntin (not official) 0.3–1.0 gm. grs. v–xv

This is a compound of proteins and hydrochloric acid, and is used as a substitute for the latter substance in the digestion of proteids. It is only half as strong as dilute hydrochloric acid.

SULPHURIC ACID (OIL OF VITRIOL)

Sulphuric acid acts like the other acids, except that it checks intestinal secretions and the sweat.

It is rarely used except as a remedy for lead poisoning and occasionally to check diarrhoea and night sweats. The

concentrated acid is occasionally used to destroy an infected area of the skin (caustic action).

Preparations

Dilute Sulphuric Acid 0.6–2.0 c.c. m. x–xxx
(Acidum Sulphuricum Dilutum)

This contains 10% of sulphuric acid.

Aromatic Sulphuric Acid 0.3–1.0 c.c. m. v–xv
(Acidum Sulphuricum Aromaticum)

This contains 20% of sulphuric acid in alcohol, flavored with ginger and cinnamon.

For Local Use

Sulphuric Acid
(Acidum Sulphuricum)
(Oil of Vitriol)

This contains 92% of sulphuric acid.

NITRIC ACID (AQUA FORTIS)

Nitric acid acts like other acids, except that it is said to increase intestinal secretions and the secretion of bile. It is occasionally used instead of hydrochloric acid to aid digestion. A drop of the strong acid is frequently applied on the skin to destroy an infected area of the skin.

Dilute Nitric Acid 0.6–2.0 c.c. m. x–xxx
(Acidum Nitricum Dilutum)

This contains 10% of nitric acid.

For Local Use:
Nitric Acid
(Acidum Nitricum)

This contains 68% of nitric acid.

NITROHYDROCHLORIC ACID

Nitrohydrochloric acid or aqua regia, is a mixture of one part of nitric and 4 parts of hydrochloric acid. It is the

most powerful acid, and the only fluid which will dissolve platinum and gold.

This diluted acid is principally used to increase the flow of bile, given in the following ways:

1. By mouth, sipped through a glass tube.
2. In a foot bath or ordinary bath.
3. It is said to be more efficient if it is applied to the liver in the form of a stupe, about 4.0–8.0 c.c. or ʒi–ii of the dilute acid being used to a pint of water.

Preparations

Dilute Nitrohydrochloric Acid (Acidum Nitrohydrochloricum Dilutum)	0.3–1.0 c.c.	m. v–xv

This contains 40 parts of nitric acid and 180 parts of hydrochloric acid in 1000 c.c. of water.

Dilute phosphoric acid is principally used as a tonic. It does not destroy tissues like the other mineral acids.

VEGETABLE OR ORGANIC ACIDS

The vegetable or organic acids are obtained from various fruit juices such as the grapes, lemons, or by the prolonged fermentation of wines.

Their effects are similar to those produced by the mineral acids, but they are milder. They do not produce poisonous effects, except when given in very large doses.

The most common organic acids used are acetic, citric, and tartaric acids.

The acetic acid is the most active one in the group, the others having a milder action.

DILUTE ACETIC ACID

Acetic acid is an organic acid formed by the prolonged fermentation of various fruits and vegetables. Thus, when wine is fermented for a long time, vinegar is formed, which consists mostly of acetic acid.

ACTION

Local action: Dilute acetic acid hardens and cools the skin;

it contracts the mucous membranes. It checks bleeding by contracting the blood vessels.

Concentrated solutions however, when locally applied, cause redness, pain, and the formation of a blister with slight destruction of the skin.

Internal Action

In the mouth: Dilute acetic acid has a very sour taste, it increases the flow of saliva, thereby lessening thirst.

In the stomach: It increases the secretion of gastric juice, it improves the appetite, and aids digestion.

In the intestines: It increases the secretions, but it is readily neutralized by the alkaline intestinal juices.

Action after Absorption

Acetic acid is rapidly absorbed from the stomach. It is oxidized in the blood to carbonic acid. It then forms carbonates by combining with the alkaline salts in the blood. The carbonates thus formed, are excreted by the urine; which is very much increased.

Poisonous Effects

The symptoms of poisoning by large doses of acetic acid, are similar to those caused by the mineral acids, but they are rarely fatal. The treatment is the same.

Chronic Poisoning

Continued use of acetic acid often causes emaciation, loss of weight, and anaemia.

Preparations

Vinegar (not official)
Acetum

Vinegar is obtained by prolonged fermentation of alcoholic liquors. The best vinegar is made from cider, and consists mostly of acetic acid.

Dilute Acetic Acid (**Acidum Aceticum Dilutum**)	2.0–8.0 c.c.	3½–ii

This is a pure form of vinegar which contains 6% of acetic acid.

These preparations are used principally to harden the skin, to check bleeding; and by inhalation, to relieve fainting (reflexly strengthening the heart action in this way). They are also used to neutralize poisoning from alkalies.

For Local Use

Glacial Acetic Acid
(Acidum Aceticum Glaciale)

This contains 99% of acetic acid.

Trichloracetic Acid
(Acidum Trichloraceticum)

This is a crystalline substance.

These two latter preparations are used to cauterize or destroy tissues. They are used principally to remove warts.

CITRIC ACID

Citric acid is an organic acid which is found in the juice of the lemon, or **Citrus limonum,** and the lime, **Citrus bergamia.**

ACTION

Citric acid acts like acetic acid.

1. It increases the flow of saliva and relieves thirst.
2. It increases the appetite and the flow of gastric juice, thereby aiding digestion.
3. It slightly increases the movements of the bowels. Thus, the juice of half a lemon, if given before breakfast is a good laxative.
4. It increases the sweat, especially if given hot, as in a hot lemonade.
5. It slightly slows and weakens the heart action.
6. It increases the flow of urine, in which it is secreted as a carbonate, and it makes the urine more acid in reaction.
7. Citric acid is frequently given to sailors as an article of diet, to prevent scurvy, a severe disease of the joints due to the lack of vegetable food in the diet.

Citric acid is not a poisonous substance, but its continued use occasionally causes anaemia and loss of weight.

Preparations

The best way of administering citric acid is in the form of lemonade. To produce sweating it is best given hot.

Citric Acid
(Acidum Citricum)

This is occasionally used in doses of 30.0 gms. (℥i), to a pint of water; instead of lemonade.

TARTARIC ACID

Tartaric acid is the acid of **grape juice.** Its action is similar to that of acetic acid.

It is principally used to increase the flow of urine, in which it is excreted as carbonates.

It is also used as a laxative, and it is an ingredient of the seidlitz powder.

Tartaric acid is usually given in the form of grape juice, as a cooling refreshing drink. As a diuretic or laxative, its various salts such as potassium tartarate, etc., are preferred.

LACTIC ACID

Lactic acid is a thick, syrupy liquid formed in milk when it turns sour as a result of bacterial fermentation. It is also formed by the fermentation of milk sugar or grape sugar.

ACTION

When taken internally, is acts like the other organic acids:

1. It increases the appetite and aids digestion.
2. It is said to increase nutrition.
3. It enters the blood as lactates and is excreted by the urine as carbonates.

It is principally used, however, as a local application to heal tuberculous ulcers of the pharynx or larynx, and to remove diphtheric membranes. The applications are very painful.

Preparations

Lactic Acid (Acidum Lacticum)	0.3–2.0 c.c.	m. v–xxx

This contains 75% of pure lactic acid.

OXALIC ACID

Oxalic acid is an organic acid, found in **sorrel** and other vegetable substances. It is never used as a medicine, but **Potassium oxalate,** or **essential salt of lemon,** and oxalic acid are frequently used to clean metal kitchen utensils. These salts resemble epsom salts in appearance, and are a frequent cause of severe poisoning, when taken by mistake, or with suicidal intent.

Oxalic Acid Poisoning

The symptoms usually appear in a few minutes:

1. Severe burning pain in the mouth or throat.
2. Intense cramp-like abdominal pain.
3. Profuse vomiting, the vomited matter containing mucus, pieces of mucous membrane and blood.
4. Muscular weakness and twitchings of the muscles.
5. Occasionally convulsions.
6. Collapse (rapid, irregular, weak, thready pulse, slow shallow breathing, cyanosis, cold moist skin, coma and death).

The patient may die in a few minutes; or in a few weeks from starvation, as a result of the injury to the stomach and intestines. 30.0 gms. or ℥i of oxalic acid usually proves fatal; though death has occurred from as little as 4.0 gms. (ʒi).

Treatment

1. Neutralize the oxalic acid at once with an alkali, such as calcium. Lime water, chalk or the plaster from the wall may be used for this purpose.

Do not give any preparation of sodium or potassium, as these form poisonous substances with the oxalic acid.

2. Give emetics.

3. Protect the mucous membranes with egg albumin, milk, etc.

4. Treat the collapse with heart stimulants such as strychnine, caffeine, digitalis, etc.

Other organic acids occasionally used are:

Hydrocyanic Acid
Tannic Acid
Gallic Acid

These are considered under their more important actions for which they are principally used.

ALKALIES AND ALKALINE EARTHS

The following drugs are used principally to neutralize acids. They are therefore often called **antacids.**

An alkali is a substance which belongs to a group of chemical substances called bases. These neutralize acids to form salts.

Alkalies combine with acids to form salts. They dissolve proteids, forming salt-like alkali proteids, and they combine with fats to form soaps.

Mode of Action

The alkalies and their salts are principally used to neutralize acids. When given internally, they combine with the acids in the stomach and form salts. They then relieve various symptoms which result from excessive acid in the stomach.

Salt Action

The salts which are formed in the stomach and intestine, or those which are given to a patient, if they are sufficiently concentrated, withdraw fluid from the blood and tissues, into the stomach and intestines, until these salts are diluted. This process is called **osmosis.**

The diluted salts are absorbed into the blood through the mucous membranes, and they then circulate throughout the body, and enter the cells of the various organs and tissues. There they set up a process of **diffusion;** the cells absorbing fluid if the proportion of salt which it contains is more than that in the fluids around them; and the cells then become swollen. Some of the cells, such as those of the kidney, for example, then become more active.

The rate of absorption of the various alkalies and their salts is variable; some being absorbed more slowly than others. Those that are very slowly absorbed, merely withdraw fluid into the intestines, which then become distended,

peristalsis results and the salts act as a purgative. The most common alkalies that are used as medicines are the salts of

Sodium
Potassium
Ammonium

The alkaline earths are:

Calcium
Magnesium
Lithium

SODIUM COMPOUNDS

Sodium is a metallic element. It is found in nature in various forms.

1. As sodium chloride or salt, in salt mines, or obtained from sea water by evaporation.
2. It is found in Chili as sodium nitrate.
3. As borax or sodium borate in various parts of the world.

ACTION

Local action: Weak solutions of sodium compounds make the skin feel soft and soapy, by dissolving the superficial epidermis, or horny layer of the skin. Concentrated solutions destroy the skin and underlying tissues, forming a soft crust, which soon falls off, leaving an ulcer. Mucous membranes are affected in the same way as the skin. Sodium compounds as well as the compounds of the other alkalies, particularly dissolve mucous.

Internal Action

In the mouth: Sodium compounds, as well as the other alkalies, have a characteristic alkaline taste.

They dissolve the mucous secretions, redden and soften the lining membrane of the mouth and tongue and make the mouth feel soapy.

In the stomach: They neutralize the acid in the stomach, thereby lessening digestion. They combine with the acids to form salts.

In the intestines: The alkalies enter the intestines as salts which have been formed in the stomach. They withdraw fluid from the blood and tissues which then distends the intestines and causes frequent movements of the bowels. It also dissolves the mucus in the intestine.

Action after Absorption

The salts of sodium are readily absorbed into the blood, which they then make more alkaline in reaction. They do not particularly affect the activity of any of the organs of the body. They are excreted mainly by the kidneys; increasing the flow of urine at the same time, and they make the urine more alkaline in reaction. They are also slightly excreted by the mucous membranes.

Preparations

Sodium Hydroxide
(Sodii Hydroxidum)
(Caustic Soda)

This comes in white sticks, which readily take up moisture from the air. It is occasionally applied as a caustic, to destroy tissue. It often causes severe injury to the tissues.

Solution of Sodium Hydroxide 1.0–4.0 c.c. m. xv–℥i
(Liquor Sodii Hydroxidi)

This is a 5% solution of sodium hydroxide in water.

Monohydrated Sodium Carbonate 0.3–2.0 gms. grs. v–xxx
(Sodii Carbonas Monohydratus)

Sodium Carbonate 0.3–2.0 gms. grs. v–xxx
(Sodii Carbonas)
(Washing Soda)

These two preparations are rarely used internally. Externally they are used to dissolve mucus and other secretions. They are frequently used to clean glass, china, woodwork, etc. They frequently cause poisonous symptoms when taken by mistake.

Sodium Bicarbonate 0.3–2.0 gms. grs. v–xv
(Sodii Bicarbonas)

This is the most commonly used preparation. It is applied locally to soothe the skin; in burns. Internally it is said to neutralize the acid in the stomach, and to relieve the pains resulting from excessive acid. It is given in seltzer or vichy. It is frequently used to soothe the stomach and to lessen vomiting.

Troches of Sodium Bicarbonate
(Troschisci Sodii Bicarbonatis)

There are numerous other preparations such as seidlitz powder, which contains sodium bicarbonate, but these are used principally as cathartics.

POTASSIUM COMPOUNDS

The salts of potassium act like the sodium compounds with the following variations in their effects:

1. Concentrated solutions such as potassium hydroxide, have a greater destructive action on the skin. They destroy the skin and underlying tissues, causing an ulcer when the resulting crust falls off.
2. The salts of potassium when absorbed into the blood, slightly weaken and slow the contractions of the heart.
3. They increase the flow of urine more than the sodium compounds.

The potassium salts are very rarely used as alkalies.

Preparations

Potassium Hydroxide
(Potassii Hydroxidum)
(Caustic Potash)

This comes in white sticks which take up moisture from the air. It is used principally as a caustic, to destroy tissues. When this is applied locally, the surrounding tissues about the spot to be cauterized, should be well protected owing to its violent action.

Solution of Potassium Hydroxide 0.6–2.0 c.c. m. x–xxx
(Liquor Potassii Hydroxidi)

This contains 5% of potassium hydroxide.

Potassium Carbonate (Potassii Carbonas)	0.3–2.0 gms.	grs. v–xxx
Potassium Bicarbonate (Potassii Bicarbonas) (saleratus)	0.3–2.0 gms.	grs. v–xxx

Potash and Lime
(Potassa cum Calce)

This is known as Vienna paste, and consists of equal parts of potash and quicklime and is used locally as a caustic.

Various salts of ammonium are used as alkalies or antacids. Their action has been described under their other more important effects.

Poisonous Effects of Alkalies

Acute poisoning frequently results from some of the alkalies when they are taken by mistake. Washing soda, lye, or sodium carbonate is commonly used for cleaning purposes. It is found in every household, and if carelessly left around the house, it is occasionally taken by children, producing very serious symptoms.

Symptoms of Alkali Poisoning

The symptoms usually appear in a few minutes after the alkali has been taken:

1. **The tissues about the lips and mouth are destroyed** and covered with a swollen white crust, and there are pieces of bloody moist shreds of tissue around the lips and mouth.
2. **Severe abdominal pains.**
3. **Profuse vomiting.** The vomited matter contains pieces of mucous membrane and blood.
4. Occasionally there is diarrhoea, the stools containing blood and pieces of mucous membrane.
5. Collapse (rapid thready pulse, slow shallow breathing, cold moist skin, and dilated pupils).

The patient may die of collapse, or occasionally from a perforation of the stomach wall, resulting from the destructive action of the alkali.

If the patient recovers, the scars which form at the areas

in the oesophagus and stomach where the tissue was destroyed, makes these organs narrower (stenosis). This condition may necessitate radical surgical treatment.

Treatment

1. Give as an antidote, a dilute vegetable acid such as lemon juice, vinegar or dilute acetic acid.

2. Protect the mucous membrane by egg albumin, oils or milk.

3. Treat the collapse with heart stimulants; such as caffeine, strychnine, atropine, digitalis, etc., and keep the patient warm.

Do not wash out the stomach, as passing a stomach tube may cause a perforation of the stomach.

Uses of the Alkalies

The alkalies are principally used:

1. To neutralize the acid in the stomach, in **hyperacidity,** a condition where there is too much acid secreted in the stomach. It is also given in **ulcers of the stomach** where the pain is due to the excessive amount of acid formed in the stomach, which is then neutralized by the alkalies. In these cases the alkalies are best given about a half to one hour after meals, when the stomach contains the largest amount of acid.

2. They are also used to dissolve mucus and other secretions.

ALKALINE EARTHS

The most common alkaline earths that are used in medicine are the salts of calcium and magnesium. These salts differ from the alkalies in being very insoluble. They are therefore not readily absorbed, and produce only a local effect in the stomach and intestines.

CALX OR CALCIUM (LIME)

Calcium salts are found very abundantly in nature. They are found in large quantities in all the tissues of animals.

As calcium phosphate, it is found in the bones and teeth of all animals. It is also found in many of the soft tissues. Calcium salts are necessary for the activity of many forms of living matter.

Many mineral substances, also contain large quantities of calcium salts. Thus, **calcium carbonate** is found in chalk, marble and limestone. **Calcium sulphate** is found in plaster of paris, gypsum and alabaster.

ACTION

Local action: The calcium salts have no effect on the skin, but they contract the mucous membranes, and are very soothing to them (astringent action).

Calx or unslaked lime however, burns and destroys tissues if applied to mucous membranes.

Internal Action

In the mouth: The calcium salts contract the mucous membranes.

In the stomach: They neutralize the acid, lessen digestion and contract and soothe the mucous membranes.

In the intestines: They contract and soothe the mucous membrane (astringent action).

Action after Absorption

The calcium salts are very slowly absorbed from the stomach and intestines. Part of these salts are absorbed into the blood, however, and help to form fibrin ferment, so that the blood clots better.

In diseases where there is an insufficient amount of calcium or lime in the body, such as rickets, the bones become softened and are often deformed. The calcium absorbed from the blood is then deposited in the bones and hardens them.

Excretion

The calcium salts are excreted mostly by the large intestine and kidneys.

Poisonous Effects

Poisoning from lime occasionally occurs when unslaked lime is swallowed. The symptoms are the same as those of poisoning by other alkalies.

Slaked lime occasionally causes severe destruction of the tissues. It gets into the eye accidentally every now and then, in those whose work necessitates its constant handling. Severe destruction of the eye, even loss of sight, may then result. In such cases, the eyes should immediately be washed out very thoroughly with a solution of boric acid.

Uses

Solutions of calcium are used locally to soothe the skin in burns. **Internally,** it is used to neutralize the acids of the stomach in **hyperacidity,** or **ulcer of the stomach.** It is also used to soothe the stomach and lessen nausea and vomiting.

When given to neutralize the acid, it is best given about a half to one hour after meals, when the stomach contains the largest amount of acid.

They are also used as antidotes for poisoning by acids.

Preparations

For Internal Use

Lime Water 30.0–120.0 c.c. ʒi–iv

Solution of Calcium Hydrate
(Liquor Calcis)

This is a saturated solution of calcium hydrate or slaked lime containing 0.17 gm. of calcium hydrate to 100.0 c.c. of water, or grs. ½–¾ to ʒi of water.

It is made by washing slaked lime with distilled water, and then filtering the resulting solution.

It is used to neutralize the acid in the stomach, to soothe the stomach and to lessen nausea and vomiting. It is very constipating.

When added to milk, it lessens curdling in the stomach and makes the milk more digestible.

Syrup of Lime 1.0–4.0 c.c. m. xv–ʒi
Syrup of Calcium Hydroxide
(Syrupus Calcis)

This contains 5% of lime.

Calcium Chloride 0.3–1.0 gm. grs. v–xv
(Calcii Chloridum) (well diluted)

This is used to increase the clotting of the blood. It is somewhat injurious to the tissues however. When fresh it is a good antiseptic, ʒvi of the calcium chloride being used to a gallon of water.

Calcium Lactate (not official) 0.2–0.6 gm. grs. iii–x
(Calcii Lactas)

This is used principally to increase the clotting of the blood in haemorrhage. It is frequently given for several days before tonsil and adenoid operations to prevent profuse bleeding. It is occasionally given hypodermically.

For Local Use

Lime Liniment
(Linimentum Calcis)
Carron Oil

This is a mixture of lime water and olive or linseed oil in equal parts.

Unslaked Lime
Calx

This is made from limestone. It forms a white mass which cracks, and changes to a powder, when placed in water, forming heat. It is then called **slaked lime** or **quick lime.**

It is used as a disinfectant and to destroy tissue (caustic).

For this purpose it is used together with potassium in the form of vienna paste or potassa cum calce.

Milk and Lime (non-official)
Whitewash

This is made by adding 1 part of slaked lime to 4 parts of water. It is used as a disinfectant, especially for typhoid and cholera stools. It is also a soothing application for burns.

Chalk Mixture (Mistura Cretae)	15.0–30.0 c.c.	℥½–i

This contains 2.0 gms. chalk suspended in 30.0 gms. water by means of gums.

MAGNESIA

The preparations of magnesia act similarly to those of calcium.

1. They neutralize the acid in the stomach.
2. They are not readily absorbed, passing into the intestines, where they act as cathartics, causing frequent fluid stools.
3. The small amount of magnesia that is absorbed, increases the alkaline reaction in the blood, and is excreted by the urine, which it increases and makes more alkaline in reaction.

Preparations

The preparations of magnesia, which are principally used to neutralize the acid in the stomach, are:

Magnesium Oxide (Magnesii Oxidum) (Calcined or light magnesia) (The Magnesia Usta of the German Pharmacopoeia)	0.3–4.0 gms.	grs. v–ʒi
Milk of Magnesia	4.0–16.0 c. c.	ʒi–℥½

This is a proprietary preparation containing magnesium hydrate. It is used as an antacid and cathartic.

The other preparations of magnesia are principally used as cathartics, under which group they are described.

LITHIUM

The salts of lithium are also alkaline in reaction and neutralize the acid in the stomach. They are principally used as diuretics and are described in that group.

CHAPTER XXI

ASTRINGENTS

Astringents are drugs which are used to contract the tissues with which they come in contact. If they are applied to mucous membranes, by contracting their cells, they lessen the secretions.

Astringents affect the tissues only locally; by the drugs combining with the proteids or albumins of the cells and thereby coagulating and hardening them.

To produce its effect, an astringent must therefore come directly in contact with the tissues upon which it acts. In large doses, the excessive coagulation of the proteids of the cells destroys the tissues, and they then act as caustics.

Astringents are divided into two groups; depending upon the nature of the substance used for this purpose. **Vegetable astringents** and **mineral astringents.**

VEGETABLE ASTRINGENTS

Vegetable astringents are vegetable substances whose principal action is to contract the tissues and lessen the secretion of the mucous membranes. These effects which they produce are due to an organic acid, **tannic acid** which all of them contain.

TANNIC ACID

Tannic acid is an organic acid which is found in a great many vegetable substances. It is obtained from powdered **nutgall** or **oak gall.** This is a vegetable growth produced in the bark of the **Quercus lusitannica,** dyers' oak, or the gall oak tree, by the puncture of a fly (the Cynips gallae tinctoriae) and the deposit of its eggs on this bark.

There are various forms of tannic acid, depending on the plant from which it is derived; for example, **gallotannic acid**, from nutgall, **kinotannic acid** from kino, **catechutannic acid** from catechu, etc.

Tannic acid is very closely related to gallic acid; which is tannic acid combined with water.

ACTION

The action of tannic acid is due to the coagulation of the proteids of the cells with which it comes in contact.

Local action: Applied to the skin, to a wounded surface or ulcer, it contracts the tissues by coagulating or hardening their cells. If applied to a bleeding point, it stops the bleeding by coagulating the proteids of the blood.

On mucous membranes: It checks the secretion, and makes them dry and contracted by hardening their cells.

Internal Action

In the mouth: It has a harsh bitter taste, and makes the mouth feel dry and contracted.

In the stomach and intestines: It contracts the mucous membrane, thereby checking its secretions and making it less susceptible to impulses that start peristalsis, which is then lessened, and the bowels are constipated.

Action after Absorption

Part of the tannic acid is changed in the intestine to gallic acid and to a salt, a tannate, which is then absorbed into the blood, but which produces no effects on the tissues or organs of the body.

Excretion

Most of the tannic acid is destroyed in the body, while a very small amount is eliminated in the stools and urine as tannic acid, gallic acid or pyrogallic acid.

Poisonous Effects

Tannic acid is not a strong poison. Large doses, by the

destruction of many of the cells of the mucous membranes of the alimentary tract, often cause nausea, vomiting and diarrhoea.

Uses

Tannic acid preparations are used principally:

1. To check excessive secretion of the alimentary tract, as in diarrhoea.
2. To check excessive secretion and swelling of mucous membranes, as in the diseased condition of the mouth in mercury poisoning.
3. To prevent bed sores by hardening the skin.
4. As an antidote to various metallic and alkaloid poisons.
5. It is often given as an astringent irrigation in the colon and vagina.

Administration

For local effect it should be given in the form of an ointment or a lotion.

For its effect in the stomach, it is best given in powder form.

For its effect in the intestines, it is best given in pill form.

Preparations

Tannic Acid (Acidum Tannicum)	0.12–0.6 gm.	grs. ii–x
Troches of Tannic Acid (Trochisci Acidi Tannici)	0.06–gm.	gr. i

For Local Use:

Glycerite of Tannic Acid (Glyceritum Acidi Tannici)

This contains 20% of tannic acid.

Tannic Acid Ointment (Unguentum Acidi Tannici)

This contains 20% of tannic acid.

Styptic Collodion (Collodium Stypticum)

This contains 20% of tannic acid.

New and Non-official Preparations

These preparations are not so apt to cause nausea and vomiting and are milder in their action.

Tannalbin 1.0–4.0 gms. grs. xv–℥i
Tannin Albuminate
(Albuminas Tannas)

This is a compound of tannic acid in albumin and is used to check diarrhoea. It is not dissolved in the stomach and acts only in the intestines.

Tannigen 0.2–0.6 gm. grs. iii–x
Tannyl Acetate
(Acidum Tannicum Diacetylicum)

It is used to check diarrhoea and acts in the intestine when it comes in contact with the intestinal juice.

Tannoform 0.25–0.5 gm. grs. iv–viii
(Tanninformaldehydum)

This is a compound of gallotannic acid with formaldehyde. It is an astringent and antiseptic and is used to check diarrhoea.

It is also used locally as a powder in 25% to 50% solutions or as a 10% ointment for eczema, profuse sweating, etc.

Tannopin or Tannon 0.3–0.5 gm. grs. v–viii
Hexamethylene Tetramine Tannin

This is used as an astringent and as an antiseptic in the intestines in chronic colitis, tuberculous enteritis, etc.

Protan 1.0–2.0 gms. grs. xv–xxx q. 2 h.
Tannin Nucleo Proteid

For children, 0.3–0.6 gm. grs. v–x q. h.

This is a compound of casein and tannic acid, containing 50% of tannic acid. It is used to check diarrhoea.

Tannacol 1.0–2.0 gms. grs. xv–xxx
Gelatine Tannate

This is used to check diarrhoea.

GALLIC ACID

Gallic acid is an organic acid which is usually made from tannic acid by its combination with water.

ACTION

Gallic acid does not coagulate albumins, and it has a milder action than tannic acid. It is more readily absorbed into the blood, and is only used to check excessive secretion of sweat, of bronchial mucus and to check bleeding from the lungs or kidney, but it is not very effective.

Preparations

Gallic Acid (Acidum Gallicum)	0.3–2.0 gms.	grs. v–xxx

GALLOGEN (not official)

Gallogen, ellagic or benzoaric acid is an acid obtained from the pods of the **divi divi** plant or **Coesalpina coraria.**

It checks diarrhoea and contracts mucous membrane.

It is given in doses of 0.6–1.0 gm. (grs. v–xv)

VEGETABLE SUBSTANCES CONTAINING TANNIC OR GALLIC ACIDS

GALLA (NUTGALL)

Galla or nutgall is a growth which forms on the bark of the **Quercus infectoria,** or gall oak tree, by the punctures and the deposited eggs of a species of fly (Cynips tinctoria). Before the larvae are formed from the ova, the galls contain about 50% of tannic acid and smaller quantities of gallic acid.

ACTION

Nutgall contracts the tissues and checks the secretion of mucous membranes because of the tannic acid which it contains. It is little used except in the form of an ointment, as a local application for haemorrhoids.

Preparations

Tincture of Nutgall (Tinctura Gallae)	2.0–12.0 gms.	grs. xxx–3iii
Nutgall Ointment (Unguentum Gallae)		
Gall and Opium Ointment (not official) (Unguentum Gallae cum Opii)		

This contains 7½% of opium.

GAMBIR

Gambir or pale catechu is an extract made from the leaves and twigs of **Ouraparia gambir,** an East Indian shrub. It is used as a powerful astringent; contracting the tissues and checking the secretions of mucous membranes, because of the tannic acids which it contains.

Preparations

Gambir	1.0 gm.	grs. xv
Compound Tincture of Gambir (Tinctura Gambir Composita)	4.0 c.c.	3i
Troches of Gambir, each containing (Trochisci Gambir)	0.06 gm.	gr. i

CATECHU

Catechu is an extract prepared from the wood of **Acacia catechu,** an East Indian plant.

It is a powerful astringent because of the tannic acid which it contains. It is not often used.

Preparations

Tincture of Catechu (Tinctura Catechu)	2.0–4.0 c.c.	3½–i
Troches of Catechu, each contains (Trochisci Catechu)	0.06 gm.	gr. i
Compound Catechu Powder (Pulvis Catechu Compositus)	0.6–2.0 gms.	grs. x–xxx

This contains catechu, kino, krameria, cinnamon and nutmeg.

KRAMERIA (RHATANY)

Krameria is obtained from the roots of **Krameria triandra,** and of **Krameriai Ixima,** para rhatany, and peruvian rhatany, two South American shrubs.

They are powerful astringents, contracting the tissues and checking the secretions, because of the tannic acid which they contain.

Preparations

Extract of Krameria (Extractum Krameriae)	0.3–1.0 gm.	grs. v–xv
Fluidextract of Krameria (Fluidextractum Krameriae)	0.6–4.0 c.c.	m. x–ʒi
Tincture of Krameria (Tinctura Krameriae)	2.0–8.0 c.c.	ʒ½–ii
Syrup of Krameria (Syrupus Krameriae)	2.0–10.0 c.c.	ʒ½–ii½

KINO

Kino is the dried juice of the **Pterocarpus marsupium,** an East Indian tree.

It is a strong astringent, contracting tissues and checking the secretions of the mucous membranes, because of the tannic acid which it contains.

Preparations

Tincture of Kino (Tinctura Kino)	2.0–8.0 c.c.	ʒ½–ii

HAMAMELIS (WITCH HAZEL)

Hamamelis or witch hazel, is obtained from the leaves, bark and twigs of **Hamamelis virginiana,** an American plant. It contains tannic acid and a volatile oil.

It contracts the tissues and checks the secretions of mucous membranes. It is used to check bleeding and to lessen inflammations.

Preparations

Fluidextract of Witch Hazel Leaves (Fluidextractum Hamamelis Foliorum)	2.0 c.c.	m. xxx
Extract of Witch Hazel (Aqua Hamamelis)	8.0 c.c.	ʒii

This is a colorless alcoholic fluid made by distilling the leaves and twigs of witch hazel. It contains very little tannic acid and a volatile oil.

HAEMATOXYLON

Haematoxylon is obtained from the wood of the logwood tree or the **Haematoxylon campechianum,** a Central American tree.

It is an excellent astringent, contracting the tissues, and checking the secretions of mucous membranes, because of tannic acid which it contains. It is used to check diarrhoea, but it is apt to stain sheets and linens a bright red color. It is also used in the laboratory, to stain tissues for microscopic examination.

Preparations

Extract of Haematoxylon (Extractum Haematoxylii)	0.6–2.0 gms.	grs. x–xxx

GERANIUM

Geranium is the underground root of the **Geranium maculatum,** crow's foot or crane's bill, an American plant.

It is used as an astringent to contract the tissues and to check the secretions of mucous membranes.

Fluidextract of Geranium (Fluidextractum Geranii)	2.0–4.0 c.c.	ʒ½–i

RUBUS (BLACKBERRY)

Rubus or blackberry is the bark of the roots of various species of the blackberry plant, such as **Rubus villosus, Rubus canadensis** and **Rubus trivialis.**

It is used as an astringent to contract the tissues and check the secretions of mucous membranes, because of the tannic acid which it contains.

Preparations

Fluidextract of Blackberry (Fluidextractum Rubi)	2.0–8.0 c.c.	ʒ½–ii

Blackberry brandy is a common household remedy used to check diarrhoea.

QUERCUS

Quercus is the bark of the white oak tree. It contracts the tissues and checks the secretions of the mucous membranes, because of quercitannic acid which it contains. It is used as an enema in prolapsus recti or haemorrhoids, and as a vaginal douche.

Preparations

Fluidextract of Quercus (Fluidextractum Quercus)	1.0 c.c.	m. xv

RHUS GLABRA (SUMACH)

Rhus glabra is obtained from the fruit of **Sumach berries,** It contains tannic and mallic acids.

It is used as an astringent gargle, diluted in two parts of water, for sore throat and pharyngitis.

Preparations

Fluidextract of Rhus Glabra (Fluidextractum Rhois Glabrae)

ROSA GALLICA (RED ROSE PETALS)

Rosa gallica consists of the red rose petals, gathered before the flowers open up.

It is used as a mild astringent and as a flavoring ingredient.

It usually comes in the form of a fluidextract, a honey, a syrup, and as a confection, for flavoring purposes.

For local use, the following preparations are used:

Stronger Rose Water
(Aqua Rosae Fortior)

Rose Water
(Aqua Rosae)

Cold Cream or Rose Ointment
(Unguentum Aqua Rosae)

CAMELLIA THEA (TEA PLANT)

Tea leaves contain large amounts of tannic acid. If they are boiled for a long time, and the leaves then squeezed out, the resulting fluid contains large amounts of tannic acid.

Chamomile, jambul, and many of the vegetable substances used as bitters, contain large amounts of tannic acid, and have, therefore, an astringent action.

MINERAL ASTRINGENTS

Mineral astringents are mineral substances which are used to contract tissues and to check the secretions of mucous membranes. Most of these substances are metals and their salts. The principal salts used for this purpose are the salts of **lead, silver, aluminium, zinc, copper and bismuth.** They usually act by coagulating the albumins of the cells, forming an albuminate of one of these metals. Many of their preparations are already combined with albumins. These are not as injurious to the tissues and are milder in their action than the others.

Of the various salts of the metals, the chlorides and the nitrates have the greatest coagulating power on the cells and the tissues, while the sulphates have less action.

LEAD (PLUMBUM)

Lead is a heavy metal; which forms salts by combining with acids, many of which are used in medicine.

ACTION

Local action: Applied to the skin, solutions of lead salts produce no effect, but on ulcers or wounded surfaces they coagulate the albumins of the superficial layer of cells, and harden them. In this way, they form a thin covering of coagulated albumin, which protects the cells from injury and promotes their healing. If applied to a bleeding spot, it stops bleeding by coagulating the albumins of the blood. **Mucous membranes** are contracted, by coagulation of the albumins of their cells, and their secretions are checked.

Internal Action

In the mouth: It has a sweet metallic taste, and it makes the mouth feel dry and contracted.

In the stomach and intestines: It checks the secretions, and lessens peristalsis, thereby causing constipation.

Absorption

Lead salts combine with the albumins in the stomach and intestines, and are then absorbed into the blood as lead albuminates, which are deposited in the various tissues of the body. They produce no effects after absorption, except perhaps if given in large doses continually, when they may make the pulse somewhat slower and stronger.

Excretion

Lead salts are very slowly eliminated from the body in the urine, the bile, the intestinal secretions, the saliva and the milk. The stools usually turn black from the lead sulphides which form in the intestine.

Poisonous Effects

When large doses of several of the lead salts, such as the lead acetate, are taken, acute poisoning occasionally results.

Symptoms

1. Severe abdominal pain.

2. Nausea and vomiting, with blood in the vomited matter.

3. Diarrhoea with bloody stools, though often there is constipation.

4. Collapse.

5. Coma, paralysis and death.

Treatment

1. Wash out the stomach.

2. Give dilute sulphuric acid.

3. Give milk or albumin water to protect the mucous membrane of the stomach and intestines.

4. Treat the collapse with heart stimulants.

Chronic Lead Poisoning

Chronic lead poisoning is the most common form of poisoning by metals. It occurs particularly in workers who are forced to handle lead or its salts, such as white lead, or type, continuously. Painters, type setters, plumbers and glaziers are frequently affected, the lead being absorbed from the skin, or getting on the food from the hands.

Occasionally, lead poisoning results from drinking water coming through lead pipes, or eating canned food from cans soldered with lead, or from food adulterated with lead; such as cakes colored with chromate of lead, etc. It often occurs from inhaling lead fumes in a room painted with lead paint, and occasionally in children, from putting lead pencils in the mouth. It also often occurs from absorption of ointments or solutions applied to wounds or ulcers.

The symptoms appear very slowly and vary in different individuals. They result from the lead affecting the alimentary tract, the blood and the nerves.

Symptoms

Symptoms of the Alimentary Tract

1. Loss of appetite, nausea, metallic taste in the mouth and bad breath.

2. **"Lead line" on the gums.** This is a dark blue line of

lead sulphide which is deposited at the junction of the gums and teeth. It may be absent if the teeth are kept very clean.

3. **" Lead Colic "** or painter's colic.

This is a very characteristic symptom, and usually appears suddenly. The patient complains of severe cramp-like abdominal pains, usually beginning around the navel, and lasting for several days, after which they disappear but soon return.

4. **Obstinate constipation.**

5. Occasionally vomiting.

6. Slow strong pulse.

Symptoms of the Blood

1. **Anaemia:** The blood cells often contain very small granules of lead.

2. Occasionally, abortion in pregnant women.

Symptoms of the Nerves

These symptoms appear later.

1. **Lead paralysis,** lead palsy or painter's palsy. The extensor muscles of both forearms usually become paralyzed, and the hands drop as a result of the contractions of the flexor muscles ("drop wrists"). Other muscles may be similarly affected.

2. Loss of sensation in areas of the skin.

3. Sharp, shooting or boring pains around the joints (arthralgia).

4. Rarely, blindness, from affection of the optic nerve.

5. **" Encephalopathia Saturnina."** These are various symptoms which occur very rarely, and are the result of the effect of lead on the brain.

Headache, dizziness, sleeplessness, deafness, stupor, weakness. Occasionally nausea, delirium, convulsions, hallucinations, etc.

In individuals who have had repeated attacks of lead poisoning, or who are exposed to lead continuously, the destruction of the cells in various organs of the body, and

their replacement by connective or scar tissue, results in various chronic diseases. Thus, **chronic nephritis** often results from the destruction of many of the kidney cells. **Arteriosclerosis** or hardening of the arteries, often results from the destruction of the cells of the blood vessel walls, and their replacement by connective tissue. Gout frequently results in patients who are continually exposed to lead.

Treatment

1. Individuals who are continually exposed to lead or its salts, can often avoid poisonous symptoms by keeping their hands and nails scrupulously clean, especially before eating; to avoid getting the lead particles in the mouth. They should move the bowels regularly, best by epsom salts, and they should take dilute sulphuric acid in lemonade regularly. Their diet should contain plenty of milk.

The patients suffering from an attack of chronic lead poisoning should be treated in the following way.

1. Move the bowels regularly by magnesium or sodium sulphate, which also helps to neutralize the lead, forming a lead sulphide, which is then excreted in the intestines.
2. Give potassium iodide, which helps to eliminate the lead.
3. Potassium sulphide baths also often help to eliminate the lead.
4. The lead colic is best controlled by atropine.
5. For the anaemia, iron should be given.
6. The paralyses usually get well if carefully treated with electricity and massage.

Uses

Lead salts are used principally on ulcers and wounds, to contract the tissues, and to check bleeding.

The lead acetate is occasionally given to check diarrhoea.

Preparations

Lead Acetate (Plumbi Acetas) (Sugar of Lead)	0.06–0.3 gm.	grs. i–v

For Local Use:

Solution of Lead Subacetate
(Liquor Plumbi Subacetatis)
(Goulard's Extract)

This contains about 25% of lead subacetate. It should be diluted, about ℥¼ being used to a pint of water.

Dilute Solution of Lead Subacetate
(Liquor Plumbi Subacetas Dilutum)

This contains ½ part of lead subacetate to 1000 c.c. of water.

Cerate of Lead Subacetate
(Ceratum Plumbi Subacetas)
(Goulard's Cerate)

This consists of lead subacetate solution, wool fat, white vaseline and camphor.

Lead Iodide
(Plumbi Iodidum)

Lead Plaster
(Emplastrum Plumbi)
(Diachylon Plaster)

This consists of lead oxide, soap and water.

Adhesive Plaster
(Emplastrum Adhaesivum)

This consists of rubber, lead plaster, and vaseline.

Soap Plaster
(Emplastrum Saponis)

This consists of soap, lead plaster and water.

Diachylon Ointment
(Unguentum Diachylon)

This consists of lead plaster, olive oil and oil of lavender.

SILVER (ARGENTUM)

Silver is a white hard glistening metal. The only salt of silver which is used to any extent in medicine is the silver nitrate.

Silver has been used in medicine for centuries, particularly by the Arabians, who used it extensively in the treatment of nervous diseases. In their system of medicine, which was based upon astrology, silver was associated with the phases of the same planet, the moon, as nervous diseases were; hence the name lunar caustic for silver nitrate.

ACTION

Silver salts coagulate or harden the albumins of the cells, thus forming an albuminate of silver, which is a thick, firm precipitate. If the preparation of silver is already combined with an albumin, its action is milder and it is not injurious to the tissues.

Local action: Applied to the skin, ulcers or wounded surfaces, dilute solutions of silver nitrate cause slight redness and itching, and contract the tissues. It also acts as an antiseptic, checking the growth of bacteria. Concentrated solutions destroy the skin by coagulating or hardening the albumins of the cells. The destroyed tissue or slough, is white in color, but soon turns brown or black on exposure to light. Mucous membranes are contracted by dilute solutions, and their secretions are lessened. Concentrated solutions, however, cause redness, swelling and destruction of the tissues.

Internal Action

When taken internally, silver salts have a metallic taste. They contract and lessen the secretions of the mucous membrane of the mouth, stomach and intestines.

Very small quantities of the silver salts are absorbed as albuminates, if given continually for some time. They are then deposited between the cells of the tissues of the body, but they produce no effects after absorption.

Excretion

Silver salts are excreted mostly by the intestines.

Poisonous Effects

Acute poisoning occasionally results from silver nitrate, taken by mistake, either in solution or in solid form.

Symptoms

1. Burning pain in the mouth, throat and stomach.
2. Nausea and vomiting; the vomited matter contains pieces of mucous membrane and often blood.
3. Diarrhoea, with blood and flakes of mucous membrane in the stools.
4. If a solution has been taken, the mouth is covered with a grayish white membrane which soons turns black.
5. Collapse (rapid, thready weak pulse, slow shallow breathing, cold moist skin and dilated pupils).
6. Coma, convulsions and death.

Treatment

1. Give plenty of common salt immediately, as an antidote. This neutralizes the silver, forming silver chloride.
2. Protect the mucous membranes with milk, albumin water, and other protecting drinks.
3. Treat the collapse with heart stimulants.

Chronic Silver Poisoning (" Argyria ")

Argyria is a condition which results from prolonged use of silver salts, but this condition is not now very common.

The silver salts are absorbed into the blood, and deposited in the various tissues of the body which then turn a dark color on exposure to light. This turns the skin a dark gray or slate color. The skin of the entire body may be thus affected, or only various regions, such as the face, the gums, etc.

Potassium iodide may be given for this condition, which does not usually respond to treatment.

Uses

Silver salts are used to check the growth of granulation tissue (newly formed connective tissue) and to contract the mucous membranes of the eye, the nose, or the mouth when these are inflamed.

The salts of silver are particularly valuable in the treatment of gonorrhoeal infections; destroying the gonococci, which cause the disease.

Preparations

The preparations of silver are divided into inorganic and organic preparations. The inorganic preparations are the ordinary salts formed by the combination of silver with a mineral acid. The organic preparations are formed by the combination of silver with albumin.

Inorganic Preparations

Silver Nitrate 0.01–0.03 gm. grs. $\frac{1}{6}$–$\frac{1}{2}$
(Argenti Nitras)

This is used in 1 to 2% solutions dropped in the conjunctiva of the eye, in newly born infants, to prevent gonorrhoeal opthalmia. In other gonorrhoeal infections and for other conditions, it is used in much weaker solutions such as 1–10000 to 1–1000.

Silver nitrate forms an explosive compound with tannic acid.

Moulded Silver Nitrate
(Argenti Nitras Fusus)
(Lunar Caustic)

This comes in hard white sticks in the form of pencils. It is used to destroy excessive granulation tissue and other tissues.

Mitigated Silver Nitrate
(Argenti Nitras Mitigatus)
(Mitigated Caustic)

This consists of one part of silver nitrate and two parts of potassium nitrate, fused into pencils like lunar caustic.

Silver Oxide 0.03–0.12 gm. grs. $\frac{1}{2}$–ii
(Argenti Oxidum)

Organic Preparations

New and Non-official Preparations

These preparations are combinations of silver with albuminous substances. They are therefore not as injurious (irritating) to the tissues, and can be used in stronger solutions as antiseptics.

Argyrol
Silver Vitellin

This is a compound of silver oxide and proteids, containing 20–25% of silver.

It is used locally as an antiseptic and astringent to mucous membranes, in 10–25% solutions; which are not injurious to the tissues. Argyrol should be very carefully used, as it stains linen a dark brown color.

Protargol
Protein Silver Salt

This is a compound of albumin and silver containing 8.3% of silver. It is used as an antiseptic, and as an astringent on mucous membranes in 1 to 10% solutions; as irrigations in 1–1000 to 1–2000 and in the form of bougies and tampons in 5–10% solutions.

Collargol (colloidal silver Credé) 0.06 gm. gr. i
(Collargolum)

This is a solution of very finely divided silver, in albumin, containing about 85% of silver. It is used as an antiseptic both locally, and injected into the blood.

It is often given by direct injection into the veins, in cases of sepsis, in ½% solutions. It is also used in the form of bougies, vaginal suppositories and dusting powders.

Collargol Ointment
(Unguentum Credé)

This contains 15% of collargol. It is used principally in acute mastitis, or inflammation of the breast.

About 2.0–4.0 gms. (grs. xxx–3i) are rubbed thoroughly on the skin.

Albargin
Gelatinose Silver

This is a compound of gelatose with silver, which contains 13–15% of silver.

Argentamin
(Liquor Argentamini)

This is a watery solution of silver nitrate and ethylen diamine containing 10% of silver nitrate. It is used in ¼–4% solutions as an antiseptic in gonorrhoea.

Argonin
Silver Casein

This is a compound of silver and casein, containing about 4% of silver. It is used in ½–20% solutions.

Silver Citrate
Itrol

This is used as injections in 1–4000 to 1–1000 solutions as an antiseptic.

Silver Lactate
Actol

This is used in 1–300 to 1–500 solutions as an antiseptic

Cargentos.

This is a 50% albuminous solution of silver with casein. It is used as an antiseptic, in the form of tablets, vaginal tampons, dusting powder, ointment or suppositories.

Novargan (Silver Proteinate)
(Argenti Proteinas)

This is a compound of silver and albumin, containing 10% of silver. It is used as a urethral injection in 15% solutions.

Hegonon
Silver Nitrate Ammonia Albumose

This is an albumin silver preparation which contains 7% of silver. It is used in 1–6000 to 1–2000 solutions.

Icthargan (Silver Icthyolate)
Argenti Icthosulphonas

This contains 30% of silver and 15% of sulphur. It is used in 1–4000 to 3% solutions.

Sophol

This is a compound of silver and methylen nucleic acid. It is used an antiseptic and astringent in 2–5% solutions, in inflammations of the eyes.

ALUMINIUM AND ALUM

Aluminium is a light metal. The only salt of aluminium which is used in medicine, is the aluminium and potassium sulphate, or alum.

ACTION

Local action: Applied to the skin, or mucous membranes, alum contracts the tissue by coagulating or hardening the cells. It checks the secretions of mucous membranes. It checks bleeding if applied to a bleeding point.

Concentrated solutions cause redness and swelling and are injurious to the tissues. (Irritation.)

Internal Action

When taken internally, alum contracts the mucous membrane of the mouth, making it feel very dry.

In the stomach and intestines: It contracts the mucous membranes and checks the secretions, causing constipation.

Some of the alum is absorbed into the blood, is changed to an albuminate and is then said to stop bleeding.

Poisonous Effects

Large doses of alum cause vomiting, diarrhoea and collapse, which may be so severe as to cause death.

In addition to the usual measures for metallic poisoning, which should be carried out, magnesium hydrate or ammonium carbonate should be given.

Uses

Alum is used principally as an astringent to contract mucous membranes.

It is used as a gargle in 1 to 5% solutions.

For douches, and as a lotion on the skin and other mucous membranes, it is used in $\frac{1}{2}$–1% solutions.

Large doses of alum are occasionally used to produce vomiting.

Preparations

Alum 0.3–1.0 gm. grs. v–xv
(Alumen)

This is aluminium and potassium acetate. Alum is very injurious to the teeth, and when given internally, it should be given through a glass tube.

Dried Alum or Burnt Alum
(Alumen Exsiccatum)

This is alum which has been dried by heat. It absorbs moisture from the air. It is often combined with 1–5 parts of alcohol to harden the skin, and prevent bedsores.

The other salts of aluminium, such as the aluminium acetate and the aluminium chloride are used as antiseptics.

Aluminium Hydroxide 0.3–1.0 gm. grs. v–xv
(Aluminii Hydroxidum)

Aluminium Sulphate
(Aluminii Sulphas)

This is used only locally.

Solution of Aluminium Acetate
(Liquor Aluminii Acetas)
(Burrow's solution)

This is used in ½–2% solutions as an antiseptic.

New and Non-official Preparations

Alumnol
Alumini Naphtholsulphonas

This is used as an astringent and mild antiseptic, in ½–5% solutions, for dressings, gargles, douches, etc.

It is used as a caustic in 10–20% solutions.

ZINC (ZINCUM)

Zinc is a metal which forms salts, many of which are used in medicine.

ACTION

Local action: Applied to the skin or mucous membranes, weak solutions of zinc salts are soothing and contract the

tissues. They lessen the secretion of mucous membranes, but this effect is very mild, however. Concentrated solutions cause redness and swelling and are injurious to the tissues. In powder form they destroy the tissue, acting as a caustic.

Internal Action

In the mouth: Zinc salts have a metallic taste, they contract the mucous membrane, check secretions, and make the mouth feel dry.

In the stomach and intestines: They contract the mucous membranes, and check the secretions, thereby causing constipation. In larger doses, they cause nausea and vomiting.

Absorption

Part of the zinc salt which is taken, is absorbed into the blood as an albuminate, and it is then said to improve the nutrition of the nervous system.

It is eliminated by the kidneys, saliva, bile, intestines, and milk.

The zinc salts which do not readily dissolve, such as zinc carbonate or zinc oxide, are not so apt to cause nausea and vomiting.

Poisonous Effects

Excessive doses of zinc salts, cause:

1. Vomiting and diarrhoea.
2. Bloody urine.
3. Jaundice.
4. Collapse.
5. Paralysis, convulsions, coma and death.

Treatment

1. Give alkalies such as lime water.
2. Give tannic acid, in the form of strong tea.
3. Milk, or albumin water, should be given to protect the mucous membrane.
4. Treat the collapse with heart stimulants.

Chronic Zinc Poisoning

Chronic zinc poisoning occasionally occurs among workers who handle zinc. It causes symptoms like those of lead poisoning.

Uses

Zinc sulphate is used to produce vomiting. The other zinc salts are used as astringents in various skin diseases and ulcers.

Preparations

Zinc Sulphate (as an emetic) 0.3–2.0 gms. grs. v–xxx
(Zinci Sulphas)

It is used as an eye wash in ¼–½% solutions and as an injection in gonorrhoea in 1–4% solutions.

Zinc Oxide 0.12–0.5 gm. grs. ii–viii
(Zinci Oxidum)

Zinc Oxide Ointment
(Unguentum Zinci Oxidum)

This contains 1 part of zinc oxide to 4 parts of benzoinated lard.

Precipitated Zinc Carbonate 0.12–0.5 gm. grs. ii–viii
(Zinci Carbonas Precipitatus)

Zinc Stearate
(Zinci Stearas)

This is used as a dusting powder on ulcers, and on various skin diseases.

Zinc Stearate Ointment
(Unguentum Zinci Stearas)

This contains 50% of zinc stearate.

Zinc Acetate
(Zinci Acetas)

This is used for injections and douches, in gonorrhoea.

Zinc Chloride
(Zinci Chloridum)

This is a white powder which is moulded into pencils.

It absorbs moisture from the air. It is used to destroy tissues. (Caustic action.) It is an ingredient of many "cancer cures," which destroy the cancerous tissue, when applied as an ointment.

Solution of Zinc Chloride
(Liquor Zinci Chloridum)

This contains about 36% of zinc chloride, and is used as a disinfectant for sinks and toilets.

Burnett's disinfecting fluid

This contains about 13–30 c.c. of zinc chloride.

Zinc Iodide 0.06–0.12 gm. grs. i–ii
(Zinc Iodidum)

It is used locally as a caustic and to increase the growth of tissue.

Zinc Valerate 0.06–0.12 gm. grs. i–ii
(Zinci Valeras)

Zinc Bromide 0.06–0.12 gm. grs. i–ii
(Zinci Bromidum)

This is used to lessen nervousness and the twitchings of chorea and epilepsy.

COPPER (CUPRUM)

Copper is a metal, many salts of which are occasionally used as drugs.

ACTION

Local action: Applied to the skin or mucous membranes, copper salts contract and harden the tissues by coagulating the proteids of the cells. They check the secretions of mucous membranes. Concentrated solutions cause redness and swelling of the tissues (irritation) and may even destroy tissue.

Internal Action

In small doses, copper salts contract and lessen the secretion of the mucous membrane of the mouth, stomach and intestines. In larger doses, they cause nausea, vomiting, and profuse flow of saliva.

Poisonous Effects

Overdoses of copper salts cause:

1. Violent abdominal pain.
2. Nausea, vomiting and diarrhoea.
3. Jaundice.
4. Collapse.
5. Convulsions, paralyses, coma and death.

The treatment is the same as for other metallic poisoning.

Chronic poisoning causes symptoms similar to those of lead poisoning.

Preparations

Copper Sulphate (blue vitriol or blue stone)
(Cupri Sulphas) as an astringent 0.015–0.12 gm. grs. ¼–ii
as an emetic 0.3 –0.6 gm. grs. v–x

It is used principally to contract the granulations which form in the eyelids in trachoma, an infectious disease of the eyelids.

It is also used to produce vomiting, as an astringent, and occasionally to destroy tissue (escharotic action).

Copper Citrate (not official)
(Cupricum Citricum)

This contains about 35% of copper. It is used as an astringent in 5–10% ointments.

BISMUTH (BISMUTHUM)

Bismuth is a crystalline metal. Many of its insoluble salts are used as medicines.

ACTION

Local action: Applied to the skin or ulcers, Bismuth salts contract the tissues. They are antiseptic and soothing. **Mucous membranes** are contracted, soothed and their secretions checked.

Internal Action

In the stomach and intestines: It contracts the mucous membranes, it coats and protects them from injurious

substances and lessens their secretions, thereby producing constipation. It also acts as an antiseptic, checking the growth of bacteria.

Most of the bismuth passes out in the stools, which turn black by the formation of bismuth sulphide. A very small amount is absorbed, but this produces no effects.

Poisonous Effects

Bismuth poisoning occasionally results when it is used for a long time; especially in the form of dressings. Such applications are more apt to cause poisonous symptoms than its internal administration.

Symptoms

The symptoms appear very slowly and resemble those of mercury poisoning. They are:

1. Profuse flow of saliva.
2. Swelling of the gums, tongue and throat, often with destruction of the soft palate, and other portions of the mucous membrane of the mouth.
3. Vomiting and diarrhoea.
4. Albumin in the urine.

The symptoms usually disappear when the dressings are removed.

Uses

Bismuth salts are used as dusting powders on the skin, as astringents, as antiseptics and to promote healing of ulcers, and sinuses.

They are principally used to coat, protect and heal ulcers of the stomach, and to check diarrhoea. They are often used to lessen nausea and vomiting.

Large quantities of bismuth pastes are often given to coat the mucous membranes of the oesophagus, stomach and intestines to enable an X-ray picture to be taken. The bismuth cannot be penetrated by the X-rays, so that the organ containing the bismuth produces a dark shadow on the picture.

Preparations

Bismuth Subnitrate 0.3–2.0 gms. grs. v–xxx
(Bismuthi Subnitras)

Bismuth Subcarbonate 0.3–2.0 gms. grs. v–xxx
(Bismuthi Subcarbonas)

Bismuth and Ammonium Citrate 0.12–0.3 gm. grs. ii–v
(Bismuthi et Ammonii Citras)

This is more injurious to the tissues than the other preparations.

Bismuth Subgallate 0.3–1.3 gm. grs. v–xx
(Bismuthi Subgallas)
(Dermatol)

New and Non-official Preparations

Bismuth Beta Naphtholate 1.0–5.0 gms. grs. xv–lxxv
(Bismuthi Beta Naphtholas)

This is used to check diarrhoea and as an intestinal antiseptic.

Bismuth Subcarbonate Preparations

Cremo Bismuth 4.0–16.0 c.c. ʒi–iv
(Mistura Bismuthi Subcarbonatis Hydrati)

Lac Bismo 4.0–16.0 c.c. ʒi–iv
(Mistura Bismuthi)

This is a mixture of bismuth hydroxide and bismuth subcarbonate.

Bismuth Subgallate Preparations

Airol (Bismuth Oxyiodogallate)
(Bismuthi Iodosubgallas)

This is a combination of bismuth oxyiodide and gallic acid. It liberates iodine and is used as a local application to wounds, in 10% solutions in glycerin or in a 10 or 20% ointment.

Bismal 0.12–0.3 gm. grs. ii–iv
(Bismuthi Methylen Digallas)

Tannismuth 0.3–0.6 gm. grs. v–x
(Bismuthi Bitannas)

This contains about 17 to 21% of bismuth.

Bismon (Colloidal Bismuth Oxide) 0.5 gm. grs. viii

This is an albuminous solution containing 20% of bismuth.

Bismuth and Iron Citrate 0.3–0.6 gm. grs. v–x
(Bismuthi et Ferri Citras)

This is used for anaemia with gastric disturbances.

Crurin Purum
(Quinolin Bismuth Sulphocyanate)

This is used principally as an antiseptic in gonorrhoea and in ulcers of the leg in 1–200 solutions.

Bismuthal

This is a mixture of pepsin, hydrochloric acid, and bismuth.

Xeroform 1.0–3.0 gms. grs. xv–xlv
(Bismuthi Tribromiphenolas)

This is used principally as an antiseptic in ulcers of the leg, eczema, and as an intestinal antiseptic.

CERIUM OXALATE

Cerium oxalate is a salt of cerium, a crystalline metal, which resembles bismuth.

It is used to check vomiting; in pregnancy, sea-sickness, and in other conditions. Its mode of action is unknown.

Preparations

Cerium Oxalate 0.12–0.6 gm. grs. ii–x
(Cerii Oxalas)

PART VI.—LOCAL REMEDIES, SERUMS AND ORGANIC SUBSTANCES

CHAPTER XXII

ANTISEPTICS AND LOCAL REMEDIES

ANTISEPTICS

Antiseptics or disinfectants are drugs which check the growth of bacteria (bacteria are very small unicellular microscopic organisms, many of which cause disease). They are divided into two groups; **germicides** and **antiseptics.**

Germicides or **disinfectants** are drugs which destroy bacteria. **Antiseptics** are drugs which check the growth of bacteria; usually by making the fluid in which they grow unfit for them to live in. **Deodorants** are drugs, most of which are also antiseptics, that destroy unpleasant odors.

The antiseptics, while checking the growth of bacteria, are also injurious to the tissue cells. They must therefore be used in such weak solutions that will affect only the bacteria, and do little harm to the tissues. Antiseptics can be classified according to their practical use in the following way:

(*a*) **Local Antiseptics**

1. **Disinfectants for rooms.**
2. **Disinfectants for sinks, clothing, excreta, etc.**
3. **Antiseptics for the hands.**
4. **Antiseptics for the skin.**
5. **Antiseptics for wounds, ulcers, sinuses, etc.**
6. **Antiseptics for mucous membrane lined cavities.**

(*b*) **Antiseptics acting after absorption**

1. **Antiseptics acting on the lungs.**
2. **Genito-urinary antiseptics.**

DISINFECTANTS FOR ROOMS

FORMALDEHYDE

Formaldehyde is a gas obtained by oxidizing wood alcohol. A solution containing 40% of formaldehyde gas is called **formalin.**

ACTION

Antiseptic Action

Formaldehyde gas vigorously destroys bacteria (germicide) and checks their growth (antiseptic). It also neutralizes unpleasant odors (deodorant).

Local action: Applied to the skin or mucous membranes, formalin hardens the tissues and checks the growth of bacteria on the surface.

When formaldehyde gas is inhaled, it causes stinging and prickling sensations in the nose, with a profuse flow of mucus from the nose, a flow of tears from the eyes, secretion of saliva, and excessive coughing, with profuse expectoration.

Internal Action

When very small doses of formalin are given internally, it causes nausea and vomiting, lessens the digestion of food and makes the pulse somewhat slower and weaker.

Poisonous Effects

Poisoning by large doses of formalin or formaldehyde gas occurs occasionally, and produces the following symptoms:

1. Nausea and vomiting.
2. Diarrhoea.
3. Shortness of breath and cyanosis (due to contracting the red blood cells and the formation of haematin in the blood).
4. Collapse, coma, convulsions and death.

The best antidote is ammonia water.

Uses

Formaldehyde gas is used principally to fumigate rooms and to disinfect clothing. It is generated in the following ways:

1. By heating a solution of formalin in the room; 150 c.c. of formalin is necessary to disinfect a room of 1000 c.c. of space.

2. By heating paraform, a solid substance which liberates formaldehyde gas. There are numerous lamps on the market which liberate formaldehyde gas in this way.

3. By a specially constructed apparatus for generating formaldehyde gas. The gas is allowed to enter the room by a rubber tube which is inserted in the key-hole.

When disinfecting with formaldehyde gas, the cracks in the door should be stuffed with cotton and the room should be kept closed for 24 hours. The unpleasant odor is removed by sprinkling ammonia water about the room.

Formalin is used in 1–200 solutions to sterilize instruments. There are a number of instrument sterilizers on the market which generate formaldehyde gas and sterilize the instruments in this way. Formalin has also been used as a mouth wash and as a douche in 1–500 to 1–1000 solutions.

It is occasionally used as a preservative for milk and other foods. A 4% solution of formalin is used to preserve tissues for microscopic examination.

Preparations

Formalin
(Liquor Formaldehydi)

This contains 37% of formalhyde gas.

Paraform or Paraformaldehyde 0.3–1.0 gm. grs. v–xv
(Trioxymethylene)

This is a solid substance which liberates formaldehyde gas on heating. It is used locally to destroy warts and also internally as an antiseptic.

There are a number of other preparations which liberate formaldehyde gas in the body; they will be described under their particular use.

SULPHUR DIOXIDE

Sulphur dioxide or sulphurous acid is a gas which is formed when sulphur is burned. It is one of the oldest disinfectants in medicine; being used since 1771. It is an excellent disinfectant for rooms; but it is apt to injure clothing, linens, carpets, etc.

Uses

Sulphur dioxide is formed when sulphur candles or sulphur masses are burnt in the room. The sulphur should be placed in a metal or porcelain dish placed in a basin of water, and the sulphur should then be burned. All cracks and key-holes in the room should be tightly closed.

CHLORINE (CHLORUM)

Chlorine is an element which occurs in the form of a greenish yellow gas. It is obtained from sea salt, and a number of its compounds are used as disinfectants.

Chlorine, bromine, and iodine, are three closely related elements called halogens, since they are all obtained from the sea; thus; chlorine from sea salt, bromine from sea water, and iodine from sea weeds.

ACTION

Antiseptic action

Chlorine gas is one of the most efficient disinfectants known; especially when it is used in the presence of moisture. The chlorine combines with the hydrogen of the water, thus setting oxygen free. The oxygen then destroys the bacteria. A 0.3% solution of chlorine will destroy even the spores of bacteria in about three hours. Chlorine also removes obnoxious odors very readily (deodorant).

Action on the Body

Local action: Concentrated solutions of chlorine gas redden the skin and produce blisters if the solution is pre-

vented from evaporating. **On mucous membranes** it increases the secretions.

Internal Action

In the mouth chlorine usually causes profuse secretion of saliva. **In the stomach and intestines** it increases the secretions. Inhalation of chlorine gas usually makes the patient cough and increases the secretions of the bronchi.

Poisonous Effects

If large doses of chlorine solutions are swallowed, the following effects are produced:

1. Redness and destruction of the tissues around the mouth.
2. Abdominal pain.
3. Nausea and vomiting.
4. Collapse (cold moist skin, rapid thready pulse, slow and shallow breathing.)

These symptoms are due to the formation of excessive amounts of hydrochloric acid in the stomach.

If the gas is inhaled, the patient has violent coughing; often with bloody expectoration.

The symptoms should be treated with alkalies, such as sodium bicarbonate; for the pain, morphine should be given; as well as albumins, milk, or flour to protect the mucous membrane of the stomach.

Uses

Chlorine is used principally to disinfect stools and urine. It is used in the form of chlorinated lime; which liberates chlorine gas. It has a special advantage in removing foul odors. Concentrated chlorine gas, liberated by a specially constructed generator is used to disinfect rooms. It is very efficient; but it bleaches various dyed materials. It is prepared by placing a dish containing equal parts of black oxide of manganese and salt in the center of the room. To this is added one tablespoonful of strong sulphuric acid diluted one third. Enough chlorine gas will thus be formed to disinfect the room.

Preparations

Chlorine water
(Liquor chlori compositae)

This is a solution containing 4 parts of chlorine gas to 1000 c.c. of water.

It should be freshly prepared, as it otherwise contains hydrochloric acid.

Chlorinated Lime or Bleaching Powder
(Calx Chlorinata)

This is a grayish white powder containing 35% of chlorine gas when fresh. It is sometimes erroneously called chloride of lime. A fresh powder forms a clear solution; otherwise the solution becomes turbid.

Solution of Chlorinated Soda 0.6–1.3 c.c. m. x–xx
(Liquor Sodae Chlorinatae)
(Labarracque's or Javelle's Solution)

This is a solution made from chlorinated lime and sodium carbonate. It contains sodium hypochlorite and sodium chloride. It liberates about 2½% of chlorine gas and is used for cleansing medicine droppers, douche nozzles and other small utensils. It is especially valuable to remove stains. It is occasionally given internally in half a tumbler of warm milk.

BROMINE (BROMUM)

Bromine is a liquid element obtained from sea water. Its action is similar to that of chlorine with the following differences:

1. It is more destructive to the tissues. It is occasionally used to cauterize infected wounds (escharotic action).
2. When given internally in the form of bromides it lessens the activity of the brain (see Bromides).

DISINFECTANTS FOR SINKS, CLOTHING, ETC.

For this purpose **formalin** is occasionally used in 10% solutions.

CARBOLIC ACID (PHENOL)

Carbolic acid or phenol is a crystalline solid substance which readily absorbs moisture from the air. It is made by distilling coal tar; it dissolves readily in water, alcohol or glycerine.

Antiseptic Action

Carbolic acid destroys all living tissues (protoplasm). In weak solutions (2–5%) it checks the growth of all bacteria except their spores. It is the most efficient antiseptic known.

Action on the Body

Local action: Concentrated solutions destroy the skin by hardening or coagulating the proteids of the cells. This forms a white crust which becomes red and shiny. The crust falls off in a few days, leaving a light brown area. Weak solutions (2–5%) produce a feeling of warmth and tingling followed by numbness and contraction of the skin. Applied to wounds, carbolic acid causes pain and redness with the formation of a white pellicle of coagulated albumin.

Local applications of carbolic acid solutions, if prevented from evaporating, as when applied in the form of a wet dressing, often destroy the skin and deeper tissues (gangrene). Gangrene of a finger or other part of the body has occasionally resulted from continued use of such wet dressings. For this reason its use as a wet dressing has been given up. **On mucous membranes:** carbolic acid checks the growth of bacteria if applied in weak solutions.

Strong solutions, if applied for some time, destroy the tissues; and if the area over which it is applied is extensive, collapse may result.

Internal Action

Carbolic acid is never given internally. When taken with suicidal intent it produces effects after absorption (see poisonous effects). There are, however, a number of drugs, such as salol, which form small amounts of carbolic acid

in the intestines. These then act as antiseptics, checking the growth of bacteria in the intestines. In this way they lessen the decomposition of the waste products in the intestines (putrefaction).

Action after Absorption

When a small quantity of carbolic acid is absorbed, either from wet dressings applied to wounds or when formed in the intestine, it occasionally produces the following effects:

1. It increases the secretion of saliva.
2. It increases the flow of urine. The urine has a characteristic smoky dark green color which soon turns brown or even black.
3. Occasionally, the patient becomes somewhat drowsy, due to the lessened action of the brain. (depression).
4. The breathing becomes somewhat deeper and faster and the pulse slower and weaker.

Excretion

In cases where a small quantity of carbolic acid is absorbed, it is rapidly eliminated by the urine in the form of various compounds which give the urine a characteristic dark green color.

Poisonous Effects

Acute poisoning from carbolic acid is not an infrequent occurrence as a result of attempts at suicide, since it is the easiest poison to obtain.

Symptoms

If a large quantity of carbolic acid is taken, the patient becomes unconscious and dies within a few minutes from a sudden paralysis of the heart and respiration. This is probably due to the sudden destruction of a large area of mucous membrane and the resulting collapse.

If smaller quantities are taken, the following symptoms appear in the order of their onset: Some of these symptoms also occasionally result from the continued use of wet dressings.

1. Pain around the mouth and lips, and in the stomach. The lips and mouth are blanched.
2. Nausea and vomiting, the vomited matter containing mucous.
3. Headache, dizziness, and noises in the ears.
4. Drowsiness and depression.
5. Collapse: rapid thready pulse, cold moist skin, the pulse falls to 40 or 50 per minute, the breathing becomes irregular, often snoring in character. Toward the end, the breathing becomes difficult and shallow, sometimes gasping, and because of the shallow breathing, the patient becomes cyanotic.
6. Finally, the patient goes into stupor, and coma, and then dies from paralysis of the respiration, in about one to ten hours.

Occasionally, convulsions occur just before death. A very characteristic symptom of carbolic acid poisoning is the dark green color of the urine, and the odor of the acid on the breath. The fatal dose is usually about ʒi–iv.

Treatment

1. Wash out the stomach with 50% alcohol.
2. Give one of the following drugs as an antidote:
   (a) Magnesium sulphate (Epsom salts).
   (b) Sodium sulphate (Glauber's salts).
   (c) Lime water and milk.

About ʒi of one of the salts dissolved in a glass of water. They form sulphocarbolates; harmless salts of carbolic acid.

3. Give alcohol in the form of whiskey or brandy, or even 50% solutions of alcohol. The alcohol neutralizes the carbolic acid; its mode of action is unknown. (A carbolic acid burn is readily neutralized, if followed immediately by the application of alcohol).
4. Protect the mucous membrane of the mouth and oesophagus with albumin water, flaxseed tea, etc. Do *not* give oils or glycerine as they help to absorb the carbolic acid.
5. Treat the collapse with heart stimulants such as caffeine, strychnine, atropine, etc., and keep the patient warm.

Uses

Carbolic acid was the first substance used as an antiseptic. It was formerly sprayed in operating rooms to disinfect the air, since most infections were supposed to come from the air. Later knowledge of the nature of infections has proven the worthlessness of this use. At the present time carbolic acid is used:

1. To disinfect sinks, toilets, sputum cups, clothing, etc., in 2–5% solutions. The articles must be soaked in carbolic acid for a half to several hours.
2. To disinfect the sick room by washing the walls and furniture. The fumes are often inhaled from such use and cause slight poisonous symptoms.
3. It is occasionally given internally to check vomiting, and as an intestinal antiseptic to check fermentation in the intestines.

Preparations

Carbolic Acid: For internal use 0.03–0.2 gm. grs. ½–iii
(Phenol)

This comes in crystals which readily take up water (hygroscopic). It is used principally for its destructive action on tissues (corrosive action).

Liquid Carbolic Acid: For internal use 0.06–0.2 c.c. m. i–iii
(Phenol Liquefactum)

This contains 90% of carbolic acid.

Glycerite of Phenol 0.12–0.3 c.c. m. ii–v
(Glyceritum Phenolis)

This contains 20% of phenol dissolved in glycerine.

Carbolic Acid Ointment
(Unguentum Phenolis)

This contains 5% of carbolic acid.

As an antiseptic carbolic acid is used in 2–5% solutions.

Carbolic Acid Derivatives

Cresols

There are a number of oily substances which are exten-

sively used as antiseptics, and are chemically closely related to carbolic acid. They are called cresols and are obtained from tars and other crude similar substances. The three cresols which are principally used are:

Metacresol
Orthocresol
Paracresol

Because they are oily solutions, they do not dissolve readily in water and are used in emulsions or soapy solutions. The antiseptic, physiological and poisonous actions of all of them are like that of carbolic acid. Metacresol is the best antiseptic and the least poisonous of the group.

Preparations

Cresol 0.06 c.c. m. i

This is a mixture of all the cresols.

Compound Solution of Cresol
(Liquor Cresolis Compositus)

This is a 50% solution of cresol in soap solution. It is used diluted as a disinfectant.

New and Non-official Preparations

Tricresol

This is a mixture of all the three cresols.

Kresamine
(Ethylenediamine Tricresol)

This contains 25% of tricresol and is used as an antiseptic like phenol and as an ointment for skin diseases.

Creolin

This is an emulsion of cresol. It is used in 1–5% solutions to disinfect sinks, excreta, toilets, etc. It is also used in ½ to 1% solutions for vaginal douches, and for bladder irrigations.

Lysol

This is a 50% solution of cresols dissolved in soap. It

forms a frothy solution in water and is used for douches and other irrigations in ½ to 1% solutions.

Lysoform

This is a combination of lysol and formaldehyde which is used as a disinfectant in 5 to 10% solutions.

Solveol
Solutol

These are solutions of cresols which have been made soluble by the addition of salts.

Other antiseptics used to disinfect clothing and excreta are:

Zinc Sulphate

This acts as a disinfectant by precipitating the proteids of the bacteria. For this purpose the following solution is used:

Zinc Sulphate	60.0 gms.	℥ii
Sodium Chloride	120.0 gms.	℥iv

These salts are dissolved in one gallon of water, and the clothes are soaked in this solution for 4–6 hours. **Zinc chloride** is occasionally used as a disinfectant, but it is not very reliable and is not therefore frequently used.

Iron Sulphate
(Ferri Sulphas)

This acts as an antiseptic by precipitating the proteids of the bacteria. It acts more readily when the bacteria are together with organic matter, such as pus or blood. It is used principally to disinfect the stools; an equal amount of the solution being used.

ANTISEPTICS USED TO DISINFECT THE HANDS

The following antiseptics are used principally to disinfect the hands of the surgeon or nurse when performing or assisting at an operation or when dressing wounds. To obtain

the maximum antiseptic action the hands should be kept in the solution for about five to fifteen minutes.

Bichloride of Mercury or **Corrosive Sublimate**
(Hydrargyri Chloridum Corrosivum)

This is used as an antiseptic in solutions of 1–10,000 to 1–1000. Continued use of bichloride is apt to be injurious to the skin, causing redness and itching. The solution should always be fresh, as the bichloride combines with the bacteria and makes old solutions inactive. It cannot be used to disinfect instruments as it turns them black (corrodes).

Mercuric Cyanide
(Hydrargyri Cyanidum)

This is used in solutions of 1–4000 to 1–2000 like bichloride, but it does not corrode instruments and does not injure the skin.

Mercuric Oxycyanide
(Hydrargyri Oxycyanidum)

Sublamine
(Mercuric Sulphate Ethylendiamine)

This is similar to calomel. It is used in solutions of 1–1000 to disinfect the hands, and for irrigations. It is also given in 3–4% solutions intramuscularly for syphilis.

Alcohol

This is used in 50–70% solutions as a very efficient antiseptic for the hands. Stronger solutions are not as active because they harden the capsules of the bacteria and do not penetrate the bacteria themselves.

" Lime and Soda "

A very common method of disinfecting the hands is by rubbing chlorinated lime and sodium carbonate together in the hands. Chlorine gas is liberated in this way which then disinfects the hands.

ANTISEPTICS USED TO DISINFECT THE SKIN

IODINE (IODUM)

Iodine is a non-metallic element obtained from the ashes of sea weeds. Iodine itself is not used in medicine, but various solutions and compounds of it are frequently employed.

Antiseptic Action

Iodine checks the growth of bacteria, having a marked disinfectant action. It has been used very extensively for the last few years to disinfect the skin in preparation for operations. It is of especial value for this purpose since it also contracts and hardens the skin so that bacteria cannot be carried from the skin to the deeper tissues of the wound. It should not be applied in a concentrated solution or when the skin is moist, as it is then apt to cause blisters or even to destroy the deeper tissues.

Action on the Body

Local action: Iodine stains the skin a dark brown color and makes it red and warm. Strong solutions cause blisters and may even destroy the skin. It is also slightly absorbed from the skin.

On mucous membranes: It produces redness, smarting and increases the secretions.

Internal Action

When taken internally, it causes nausea and occasionally vomiting and diarrhoea. It is readily absorbed from the stomach in a few minutes.

Action after Absorption

The iodine combines in the blood with the sodium or potassium salts; thus forming iodides. The effects then produced are like those of the iodides. (See page 487.) They increase the secretion of all the secretory glands, such as the saliva, the mucous from the nose and bronchi. They also increase

the absorption of newly formed tissues (they are often given to reduce enlarged lymph nodes). At the same time, by increasing the secretion of the thyroid gland, the pulse becomes more rapid and the patient becomes quite nervous.

Excretion

Iodine is eliminated from the body in a few minutes; by all the secretions as well as by the kidneys.

Poisonous Effects

Acute poisoning from iodine occurs very rarely; usually from the injection of iodine into cysts in order to obliterate them, and occasionally from iodine taken with suicidal intent.

Symptoms

1. Nausea and continuous vomiting. The vomited matter contains iodine which turns blue if starch is also present.
2. Diarrhoea.
3. Cyanosis.
4. Collapse, rapid thready pulse, cold moist skin, slow shallow breathing and dilated pupils. Death usually occurs in a few days.

Treatment

Give boiled starch as an antidote. Protect the mucous membrane with albumin water, milk or other protecting drinks; treat the collapse with heart stimulants; such as caffeine, atropine, strychnine, etc.

Chronic Poisoning " Iodism "

Continued use of iodine often causes the following symptoms.

1. Skin eruptions, beginning at the site of application; consisting of areas of redness.
2. Increased secretion of mucous from the nose and bronchi.
3. Rapid pulse.
4. Nervousness and tremors of the fingers.

The symptoms usually disappear when the iodine applications are stopped.

Preparations

Tincture of Iodine (Tinctura Iodi) 0.2–0.5 c.c. m. iii–viii

This contains 7% of iodine and 5% of potassium iodide in alcohol.

Compound Iodine Solution (Liquor Iodi Compositus) (Lugol's Solution) 0.2–0.8 c.c. m. iii–xii

This contains 5% of iodine dissolved in 10% of potassium iodide solution.

Iodine Ointment (Unguentum Iodi)

This contains 4% of iodine.

Sulphur Iodide (Sulphuris Iodidum)

This is a mixture of iodine and sulphur.

Losophan (Not official)

This is a preparation containing 78% of iodine which is used as a powder or in 10–20% solutions.

SULPHUR

Sulphur is an element which occurs in the form of a yellow powder. It is found in volcanoes and also as compounds of various metals forming sulphides (a sulphide is a compound of sulphur with another element or with a metal). The action of sulphur is due to the sulphides which it forms in the body.

ACTION

Local action: Applied to the skin it slightly checks the growth of bacteria and destroys parasites (parasiticide). It stains silver objects black, because of the silver sulphide which it forms.

Internal Action

When taken internally, the sulphides which it forms in the intestines increase the secretions; producing mild movements of the bowels. It is eliminated from the body as sulphides by the expired air; to which it gives a very foul odor, and also by the stools.

Poisonous Effects

Continued use of sulphur often causes anaemia, great wasting and tremors of the muscles.

Preparations

Sulphur Ointment
(Unguentum Sulphuris)

This contains 15% of sublimed sulphur with benzoin and lard.

Liver of Sulphur
(Potassa Sulphurata)

This is a preparation of sulphur which is often used in ointments and baths in doses of ʒi–vi of sulphur to a gallon of water. This substance is very destructive to tissues (corrosive).

Thilanin (Not official)

This is a mixture of lanolin and sulphur containing about 5% of sulphur. For other preparations of sulphur used as cathartics see page 100.

ICHTHYOL (Not official)

Ichthyol is a substance obtained from a peculiar bituminous mineral found in the Tyrol. It is formed by the deposits of fossil fish and contains about 10% of sulphur.

ACTION

Applied to the skin ichthyol is slightly antiseptic and causes redness. **When given internally it acts as an antisep-**

tic in the intestines. In large doses it is apt to cause slight nausea and vomiting. The same effects occasionally result when it is absorbed from the skin.

Ichthyol is used as an antiseptic and mild irritant in various skin affections.

Preparations

Ichthyol 0.2–2.0 c.c. m. iii–xxx
(Ammonii Icthosulphonas)

This is a reddish brown substance which dissolves readily in water. It is used in the form of watery solutions or ointments in from 1–20% solutions.

Sodium Ichthyol
(Sodii Icthosulphonas)

Calcium Ichthyol
(Calcii Ichthosulphonas)

Ichthargan
(Argenti Ichthosulphonas)

This contains 30% of metallic silver and 15% of sulphur. It combines the action of both.

Ferrichthyol	1.0–2.0 gms.	grs. xv–xxx
Ichthalbin	0.6–1.3 gms.	grs. x–xx
(Ichthyol Albuminate)		
Ichthoform	0.6–2.0 gms.	grs. x–xxx
(Ichthyol Formaldehyde)		

This is given in gruel or cocoa as an intestinal antiseptic. It is also used to disinfect rooms, for irrigations and in douches.

THIOL (THIOLUM) (Not official)

Thiol is an artificial substance formed by the action of sulphur on the tar obtained from brown coal. Its action is like that of ichthyol. It is used in the treatment of burns.

Preparations

Dry Thiol
(Thiol Siccum)

This contains 8% of sulphur and is used as a dusting powder on wounds.

Liquid Thiol
(Thiol Liquidum)

This contains about 2% of sulphur and is used in various skin diseases.

Tumenol
(Tumenol Venale) } **Tumenol Ammonium**

These are artificial preparations made from the same mineral as ichthyol. They act like ichthyol and are used in solutions of from 5–20%.

RESORCIN

Resorcin or resorcinol is a chemical substance made from carbolic acid.

ACTION

The action of resorcin is like that of carbolic acid.

Local action: Applied to the skin it checks the growth of bacteria; acting as an antiseptic and disinfectant.

When given internally it produces the following effects:

1. It checks the growth of bacteria in the stomach and intestines.
2. It reduces temperature, and increases perspiration.
3. It makes the pulse slower.

Overdoses of resorcin produce the same poisonous effects that result from carbolic acid poisoning. (See page 574.)

Uses

Resorcin is used principally as an antiseptic in skin diseases, such as dandruff, baldness, etc. It is occasionally used as an intestinal antiseptic and to reduce temperature.

Preparations

Resorcinol (Metadioxybenzol)	0.3–0.6 gms.	grs. v–x

Externally this is used in 5–10% solutions.

Euresol (Not official)
(Resorcin Monacetate)

This acts like resorcin and is especially valuable in dandruff and baldness.

Pyrocatechin and **Hydroquinoine** are the derivatives of carbolic acid which are rarely used in medicine.

PYROGALLOL

Pyrogallol or pyrogallic acid is a light crystalline substance made by heating gallic acid.

ACTION

The action of pyrogallol is similar to that of carbolic acid.

Applied to the skin of mucous membranes it checks the growth of bacteria, acting as an antiseptic; it destroys parasites and produces redness of the skin. It usually stains the skin or clothing a dark brown color.

Pyrogallol is occasionally absorbed from the skin and produces poisonous symptoms which resemble those of carbolic acid poisoning. (See page 574.)

Preparations

Pyrogallol
(Pyrogallic Acid)

This is used in the form of 5–20% ointments.

New and Non-official Antiseptics

Antiformin

This is a strongly alkaline solution of sodium hypochlorite. It rapidly dissolves the bodies of all bacteria, except the tubercle bacilli; it dissolves all secretions such as sputum,

and also destroys unpleasant odors. It is therefore a disinfectant, antiseptic and deodorant. It is said to be a stronger disinfectant than carbolic acid. It is also used to test the sputum and other secretions for tubercle bacilli. Antiformin is used externally in 2–10% solutions, and as a spray in 1–1000 solutions.

Anthrasol

This is a colorless coal tar which has been freed from pitch, coloring matter and other substances and is then mixed with juniper tar. It is used as an antiseptic for the skin, to destroy parasites and to soothe the skin. It is usually given in ointments of 5–30% in various skin diseases.

Afridol

This is an artificial chemical substance used to disinfect the hands, as a surgical antiseptic, and for various skin diseases. It usually comes in the form of a soap containing about 4% of afridol.

Chinosol

Chinosol or oxyquinoline sulphate is an artificial chemical substance which comes in the form of a yellow powder. It is used as an antiseptic for the skin, as a nasal spray, as a gargle and for douches in 1–5000 to 1–1000 solutions.

Alumnol
(Alumini Naphtholsulphonas)

This is used in ¼–1% solutions as a surgical antiseptic, as a gargle and for douches.

Phenoco

This is a mixture of coal tar creosote and other coal tar derivatives in soap solution. It is used as a surgical antiseptic in 1–5% solutions.

Veroform

This is a liquid obtained by dissolving formaldehyde gas in a solution of soap. It contains 6–20% formaldehyde gas and is used as a surgical antiseptic.

ANTISEPTICS USED AS DRESSINGS FOR WOUNDS, ULCERS AND SINUSES

The following antiseptics are the ones most frequently used as wet dressings or to irrigate wounds, ulcers and sinuses.

Corrosive Sublimate In 1–10,000 to 1–1000 solutions
(Bichloride of Mercury)

Aluminium Acetate Solution
(Burrow's Solution)

This is used in ½ to 2% solutions and is especially valuable when it is desired to harden the tissues.

Boro Salicyl Solution
(Thiersch Solution) (See page 499.)

OXIDIZING DISINFECTANTS

The following drugs act as disinfectants by liberating oxygen when they come in contact with organic matter.

HYDROGEN PEROXIDE

Hydrogen peroxide or hydrogen dioxide is a liquid which is a chemical compound of equal parts of hydrogen and oxygen. A 3% solution of hydrogen peroxide is used in medicine.

ACTION

Local action: Hydrogen peroxide solution is decomposed when it comes in contact with organic matter, such as pus or blood. It then yields bubbles of oxygen. The oxygen then destroys the bacteria with which it comes in contact and disinfects the tissues. At the same time it helps to loosen the membranes and pieces of dead tissues (sloughs). The effect of the peroxide wears off very rapidly. The more pus or dead tissue there is in the wound, the more oxygen is liberated.

It is used principally to irrigate wounds or sinuses containing pus. It is also used in infections in the mouth and throat and other mucous membrane lined cavities.

Hydrogen peroxide, together with sodium bicarbonate is used to bleach the hair.

Preparations

Hydrogen Dioxide
(Aqua Hydrogeni Dioxidi)

This contains about 3% of hydrogen peroxide and forms about ten volumes of oxygen for every volume of the peroxide used.

New and Non-official Preparations

The following drugs are compounds of hydrogen peroxide made by replacing the hydrogen by a metal. They act as disinfectants and antiseptics like hydrogen peroxide; by liberating oxygen. Their effect is said to be more lasting, however, since the oxygen is given off very slowly. They are often used internally as intestinal antiseptics.

Calcium Peroxide (Calcii Peroxidatum)	0.06–0.3 gm.	grs. i–v
Magnesium Peroxide (Magnesii Peroxidatum)	0.25–0.5 gm.	grs. iv–viii

Sodium Peroxide
(Sodii Peroxidatum)

This is only used externally in the form of a paste or soap in skin diseases like acne.

Oxone: This is a preparation of fused sodium peroxide.

Strontium Peroxide
(Strontium Peroxidatum)

Zinc Peroxide
(Zincum Peroxidatum)

These are used externally in the form of gauze, as a dusting powder or a 10% ointment. Peroxide zinc soap is a soap containing 10% of zinc peroxide.

Acetozone
Alphozone } **(Succinic Dioxide)**

These are artificial chemical substances which act like peroxide. They are used in 1–3000 to 1–1000 solutions on wounds, for instruments and for douches.

POTASSIUM PERMANGANATE

Potassium permanganate is a salt of manganese.

ACTION

When potassium permanganate comes in contact with organic substances, such as the albumins of the tissues, it combines with the albumins and liberates oxygen, which destroys bacteria; acting as an antiseptic and disinfectant. When it has combined with the albumins, it no longer liberates oxygen and is therefore not effectual.

Preparations

Potassium Permanganate 0.06–0.2 gm. gr. i–iii
(Potassii Permanganas)

For the hands and wounds it is used in 1–3% solutions. It is also used as a gargle and for douches in 1% solution.

Zinc Permanganate
(Zinci Permanganas)

This acts like potassium permanganate and is principally used as an injection in gonorrhoea.

Other oxidizing antiseptics are:

Sodium Perborate
(Sodii Perboras)

This is the sodium salt of perboric acid. It contains 9% of oxygen and is used as an antiseptic for wounds and ulcers and as a dusting powder.

Perogen Bath Salts or Oxygen Bath Salts is a compound containing 10% of sodium perborate.

IODOFORM

Iodoform is a yellow crystalline powder which has a very characteristic odor and a sweet taste. It is a compound of methane (marsh gas) with iodine and contains about 97% of iodine.

ACTION

Local action: Applied to the skin, to wounds or mucous membranes, iodoform acts as a mild antiseptic and disinfectant. It absorbs the fluids from the wound and in this way it prevents the growth of bacteria. Iodoform is very soothing to the skin or mucous membranes.

Poisonous Effects

Iodoform in often absorbed into the blood from wounds or sinuses, especially when the surface of the wound is very extensive. This is more apt to occur in adults or susceptible individuals. It produces the following characteristic poisonous symptoms.

1. In mild cases there may be only a rise of temperature; 104° to 105° F. Headache, dizziness, very rapid pulse and loss of appetite, also occasionally occur.

In severe cases the following symptoms may also occur:

2. The patient feels depressed, downhearted, even melancholy.
3. Hallucinations (ideas of being persecuted and attempts at suicide).
4. Delirium, even mania.
5. Collapse, which may cause death.

The symptoms may last for several hours or days. Occasionally there is no excitement, the patient goes into stupor and dies of collapse.

Preparations

Iodoform (Iodoformum)	0.03–0.2 gm.	grs. ½–iii

This is used principally externally in wounds and sinuses in the form of Iodoform gauze.

Iodoform gauze is made by soaking sterile gauze in a solution containing 5–10% of Iodoform, 20–15% of glycerine and adding alcohol up to 100 c.c.

Iodoform Ointment
(Unguentum Iodoformi)

This contains 10% of iodoform.

New and Non-official Derivatives

Iodol 0.25 gm. grs. iv
(Iodolum)

This is an artificial chemical substance formed by the action of iodine on mineral oils. It contains 85% of iodine, but its odor is not as unpleasant as that of iodoform.

Iodoformogen
(Iodoformalbumen)

This is an odorless compound of iodoform and albumin. It is used principally as a dusting powder.

Aristol
(Thymolis Iodidum)

This is a yellowish brown powder which is used like iodoform but it has a more pleasant odor.

Europhen: This is an artificial chemical substance which is used as a dusting powder. It is occasionally given internally in doses of 0.2–0.3 gm. (grs. iii–v).

Vioform: This is an artificial chemical substance, containing iodine, which acts like iodoform. It is more efficient than iodoform and does not cause poisonous symptoms.

Antiseptol
Antiseptin
Sozoiodol
Sozal
Sulphaminol
Thiophene

} These are other unofficial derivatives of iodoform.

BISMUTH PREPARATIONS

A number of preparations of bismuth have been made, consisting of bismuth combined with a carbolic acid deriva-

tive. The bismuth itself is only slightly disinfectant. This action being due to its insolubility, so that the fluid from the wounds is absorbed and the bacilli are unable to grow. Most of the antiseptic action, however, is due to the phenol derivative.

Preparations

Bismuth Subgallate (Dermatol)
(Bismuthi Subgallas)

This is used as an antiseptic dusting powder on wounds. Gauze soaked in bismuth is now frequently used instead of iodoform gauze. Bismuth paste is frequently injected into deep wounds (sinuses) to make them heal more readily.

Bismuth Subcarbolate
(Bismuthi Subcarbolas)

New and Non-official Preparations

Airol
(Bismuth Iodosubgallate)

This combines the action of iodoform and bismuth and is odorless.

Thioform
(Bismuthi Dithio Salicylate)
Xeroform
(Bismuthi Tribromphenolas)
Bismuth Phenolate
Bismuth Cresolate
Bismuth Sulphocarbolate
Dermol
(Bismuth Chrysophenate)
Eudoxin

These are used as antiseptic and astringent dusting powders for wounds and various skin diseases. They are also given as intestinal antiseptics in doses of 1.0–4.0 c.c. (grs. xv–℥i).

PICRIC ACID

Picric acid is a yellow crystalline powder.

ACTION

When applied locally it checks the growth of bacteria (antiseptic) and contracts the skin and mucous membranes.

It is used as wet dressings on burns and other wounds and occasionally as douches. It is often applied in the form of an ointment.

In large doses it is absorbed from the skin and causes the following poisonous symptoms: A yellow color of the skin, and mucous membranes, and of the urine, and occasionally convulsions and collapse.

ANTISEPTICS USED FOR MUCOUS MEMBRANE LINED CAVITIES

BORIC ACID AND BORAX

Boric acid or boracic acid is a weak acid formed by the combination of the element boron with hydrogen.

ACTION

Local action: Applied to the skin or mucous membranes, boric acid checks the growth of bacteria, but does not destroy them (antiseptic). It is also soothing to the skin.

Boric acid is rarely used internally, but when it is given, it increases the flow of urine.

Poisonous Effects

The irrigation of abscess cavities, the pleural cavity and other cavities of the body with boric acid, has occasionally caused the following symptoms:

1. Abdominal pain.
2. Nausea, vomiting and diarrhoea.
3. Headache and dimness of vision.
4. Collapse; rapid, thready pulse, slow shallow breathing and subnormal temperature.

These symptoms may cause death.

Continued use of boric acid even in the form of wet dressings, causes scaly skin eruptions such as eczema, and baldness.

Uses

Boric acid is used as an antiseptic for mucous membranes

such as the conjunctiva. It is especially valuable as a mouth wash and gargle because of its mild action, and it is the principal ingredient of most mouth washes. It is also used to irrigate wounds and abscess cavities.

Preparations

Boric Acid (Boracic Acid) 0.3–1.0 gm. grs. v–xv
(Acidum Boricum)

For external use 2–5% solutions are employed.

Sodium Borate (Borax) 0.3–1.0 gm. grs. v–xv
(Sodii Boras)

Boroglycerine
(Glyceritum Boroglycerini)

This is a compound formed by heating boric acid in glycerine. It contains 31% of boric acid.

Liquor Antisepticus

This is a compound containing 2% of boric acid together with benzoic acid, thymol, eucalyptol, oil of peppermint and oil of thyme. It is marketed under the name of **Glyco Thymoline.**

Dobell's Solution

This contains 1½% of sodium borate, carbolic acid, sodium bicarbonate, glycerine and water. It is used as an alkaline gargle and as an antiseptic nasal douche.

Boric Acid Ointment
(Unguentum Acidi Borici)

This contains 10% of boric acid.

Listerine (Not official)

This is a compound containing 2½% of boric acid, together with benzoic acid, thymol, eucalyptol, oil of wintergreen, oil of peppermint, tincture of baptista, alcohol and water.

For the nose and larynx the following preparations are principally used:

Boric Acid (in 2–5% solutions)
Dobell's Solution
Eucalyptol
Benzoin

INTESTINAL ANTISEPTICS

NAPHTHALENE

Naphthalene is a substance obtained from coal tar.

ACTION

Applied to the skin or mucous membranes it checks the growth of bacteria. **When given internally,** it checks the growth of bacteria in the intestines thereby relieving the formation of gas. A little of the naphthalene is absorbed into the blood, and this is eliminated by the lungs. Here it increases the secretion of the mucous membrane and also acts as an antiseptic. Most of it is excreted by the foeces.

Large doses cause symptoms like that of carbolic acid poisoning.

Naphthalene is used principally as an intestinal antiseptic for tape worms; to increase coughing, and as an antiseptic for abscesses in the lungs.

Preparations

Naphthalene 0.06–0.3 gm. grs. i–v
(Naphthalenum)

Betanaphthol 0.2–0.6 gm. grs. iii–x
(Naphthol)

Betanaphthol Benzoate (Not official) 0.2–0.5 gm. grs. iii–viii
(Naphtholis Benzoas)

This forms benzoic acid and naphthol in the intestines.

Betol (Not official) 0.3–0.5 gm. grs. v–viii
(Naphtholis Salicylas)

This forms salol and naphthol in the intestines.

All these preparations should be given in keratin coated pills so that they will be dissolved only by the alkaline juices in the intestines.

THYMOL

Thymol is a stearoptene resembling carbolic acid chemically, which is obtained by evaporating the oil of thyme. This is a volatile oil obtained from **Thymus vulgaris** and other similar herbs which are found in most countries.

ACTION

Thymol produces the following effects:

1. It acts as an antiseptic on the skin and mucous membranes.
2. It checks the growth of bacteria in the intestines; thereby lessening fermentation.
3. It is said to lower temperature, and it produces perspiration.

Large doses occasionally cause ringing in the ears, deafness, diarrhoea and delirium.

It is used principally as an antiseptic gargle and mouth wash, as an intestinal antiseptic, and as a remedy for hook worm.

Thymol	0.03–2.0 gm.	grs. ½–xxx

EUCALYPTOL

Eucalyptol is a substance obtained from the oil of eucalyptus and other volatile oils. The oil of eucalyptus is the active volatile oil of the **Eucalyptus globulus,** or **blue gum tree,** which grows in southern countries and has the peculiar quality of absorbing moisture from the soil. It is therefore used to drain swamps, and in this way it helps to purify a malarial district; since mosquitoes develop in swampy regions.

ACTION

Eucalyptol produces the following effects:

1. **Locally;** it acts as an antiseptic and reddens the skin and mucous membranes.
2. **Internally;** it checks the growth of bacteria in the intestines and increases the secretions.
3. After absorption it increases all the secretions, such

as the perspiration and bronchial mucous. It also makes the pulse stronger and faster.

4. It is used in the treatment of malaria, as an intestinal antiseptic, and is inhaled in lung abscesses and fetid bronchitis.

Preparations

Eucalyptol	0.3–1.0 c.c.	m. v–xv
Oil of Eucalyptus	0.3–1.0 c.c.	m. v–xv
Apinol	0.3–1.0 c.c.	m. v–xv

This is a substance obtained by the destructive distillation of pine wood. It is used principally as an intestinal antiseptic and to loosen the mucous in the bronchi.

CHARCOAL (Carbo ligni)

Charcoal is obtained by burning wood or bones. It readily absorbs gases, and in this way it removes foul odors (deodorant).

It is given in doses of 2.0–4.0 gms (ʒ½–i) in wine, or between two slices of bread and butter.

ANTISEPTICS ACTING AFTER ABSORPTION

The following group of drugs act as antiseptics on the various organs by which they are excreted.

ANTISEPTICS ACTING ON THE LUNGS

CREOSOTE

Creosote is a substance made by distilling wood tar. It consists of a number of compounds of hydrogen and carbon, many of which are related chemically to carbolic acid.

ACTION

The action of creosote is similar to that of carbolic acid; it is not as strong an antiseptic as carbolic acid, but it is more poisonous. It produces the following effects.

1. **Locally** it relieves pain and acts as an antiseptic.
2. **When given internally** it acts as an intestinal antiseptic.

3. It is absorbed from the intestines and it then lowers temperature, increases the perspiration and all the secretions, especially the bronchial secretions.

4. It is eliminated by the lungs and urine. It acts as an antiseptic in both of these organs.

Creosote is used principally as an antiseptic in pulmonary tuberculosis or lung abscesses; to destroy the bacteria in the lungs. It is often given by inhalation.

Preparations

Creosote (Creosotum)	0.06–0.3 c.c.	m. i–v
Creosote Water (Aqua Creosoti)	2.0–8.0 c.c.	ʒ½–ii

This contains 1% of creosote.

Creosote Carbonate (not official) **(Creosotal)**	0.3–2.0 gms.	grs. v–xxx

GUIACOL

Guiacol is a colorless volatile liquid made by the distillation of beechwood tar creosote.

The action of guiacol is like that of creosote, with the following differences:

1. It may be absorbed from the skin and then reduce temperature.

2. Large doses often turn the urine a dark brown color and cause diarrhoea.

It is used for the same conditions as creosote.

Guiacol	0.5 c.c.	m. viii
Guiacol Carbonate (Duotal) (Guiacol Carbonas)	0.3–1.3 gm.	grs. v–xx

New and Non-Official Preparations

Guiacol Salol (Guiacolis Salicylas)	1.0 gm.	grs. xv
Guiamar	0.3–1.3 gms.	grs. v–xx
Guiajasanol	1.0–3.0 gms.	grs. xv–xlv

Monotal (Guiacolis Methylglycolas)	2.0–4.0 gms.	3½–i
Guiacol Cinnamate (Styracol)	1.0 gm.	grs. xv

This combines the antiseptic properties of guiacol and cinnamic acid.

GENITO-URINARY ANTISEPTICS

The drugs in the following group are used principally as urinary antiseptics. They are eliminated by the urine, destroying the bacteria in the kidneys, ureters and bladder, in their passage through these organs.

BENZOIC ACID AND ITS SALTS

Benzoic acid or flowers of benzoin is an organic acid obtained from benzoin; the hardened sap of the **Styrax benzoini,** a Peruvian tree. Benzoic acid is one of the oldest antiseptics known. It was contained, together with cinnamic acid, a closely related substance, in the balsams which the Egyptians used to embalm their dead. The excellent preservation of their mummies even at the present time attests to the efficiency of these substances.

ACTION

Local action: Applied to the skin or mucous membranes benzoic acid acts as an antiseptic. It also increases the secretion of all mucous membranes.

Internal action: When taken internally, benzoic acid or its compounds check the growth of bacteria in the intestines. It is absorbed from the stomach and intestines, and it then makes the pulse faster, and increases the secretions; especially the sweat and bronchial secretions.

It is eliminated by the urine; which it slightly increases. It acts as an antiseptic along the urinary tract. It is excreted as hippuric acid, which makes the urine more acid in reaction.

Preparations

Benzoic Acid (Acidum Benzoicum)	0.3–1.0 gm.	grs. v–xv
Sodium Benzoate (Sodii Benzoas)	0.3–2.0 gms.	grs. v–xxx

This is used principally as a urinary antiseptic. It is also frequently used as a preservative for canned foods.

Ammonium Benzoate (Ammonii Benzoas)	0.3–2.0 gms.	grs. v–xxx
Lithium Benzoate (Lithii Benzoas)	0.3–2.0 gms.	grs. v–xxx

Benzoin

This is the thickened sap obtained from the **Styrax benzoini,** a Peruvian tree. Its compounds are used principally to increase the secretions in the lungs, and in inflammations of the nose and bronchi.

Tincture of Benzoin (Tinctura Benzoini)	2.0–4.0 c.c.	ʒ½–i
Compound Tincture of Benzoin (Tinctura Benzoini Composita)	2.0–8.0 c.c.	ʒ½–ii

This contains benzoin, styrax, aloes and balsam of Tolu. It was formerly known as **Balsamum traumaticum.** It is contained in a number of old remedies, such as **Friar's balsam, Turlington's balsam, Jesuits drops,** etc. It is frequently given by inhalation for inflammations of the larynx and bronchi. Benzoin is also contained in the balsam of Peru and balsam of Tolu.

Cinnamic acid is a substance closely related chemically to benzoic acid and produces the same effects.

Styrax or **storax** is the sap obtained from the inner bark of the **Liquidamber orientalis,** an Asiatic tree. It contains cinnamic acid.

DRUGS CONTAINING VOLATILE OILS ACTING AS GENITO-URINARY ANTISEPTICS

The following drugs act as antiseptics on the mucous

membranes of the genito-urinary tract, by virtue of the volatile oils which they contain. They all have practically the same action.

ACTION

When applied locally, they redden the skin or mucous membranes.

When taken internally, they check the formation, and aid in the expulsion of gas from the intestines, and act as cathartics. They are absorbed from the stomach and intestines, but produce no effects, except a slight reduction of temperature.

They are eliminated by the urine and expired air, acting as antiseptics on the mucous membranes of the organs through which they are excreted. They slightly increase the flow of urine.

The drugs of this group are used principally as antiseptics for gonorrhoea, cystitis, etc.

Large doses often cause nausea and vomiting and various rashes, such as urticaria.

Preparations

COPAIBA: An oleoresin obtained from the sap of the **Copaiba Langsdorfii,** a tree growing in Brazil and other South American countries.

Copaiba	0.6–2.0 c.c.	m. x–xxx
Oil of Copaiba (Oleum Copaibae)	0.6–1.0 c.c.	m. x–xxx

CUBEBS: A powder made from the unripe fruit of the **Piper Cupeba,** an East Indian Plant.

Fluidextract of Cubebs (Fluidextractum Cubebae)	0.6–2.0 c.c.	m. x–xxx
Oleoresin of Cubebs (Oleoresinae Cubebae)	0.6–1.0 c.c.	m. x–xv
Oil of Cubebs (Oleum Cubebae)	0.6–1.0 c.c.	m. x–xv

SANDAL WOOD OIL: A volatile oil distilled from the wood of the **Santalum album,** an American tree.

Oil of Sandal Wood (Oleum Santali)	0.6–1.0 c.c.	m. x–xv

OIL OF ERYGERON: This is a volatile oil obtained by distilling **Erygeron canadense,** or Canada fleabane, an American herb. It is used as a genito-urinary antiseptic, to check bleeding and to increase menstruation.

Oil of Erygeron (Oleum Erygerontis)	0.3–2.0	m. v–xxx

BUCHU: This is a substance obtained from the leaves of the **Barosma betulina** and **Barosma crenulata,** two South American plants. Its active principle is a stearoptene, **Diosphenol,** which is excreted by the urine and acts as an antiseptic along the genito-urinary tract. It is used in the treatment of gonorrhoea.

Fluidextract of Buchu (Fluidextractum Buchu)	2.0–4.0 c.c.	ʒss–i

MATICO: This is the dried tops of **Piper angustifoliorum,** a South American plant. It is used as a genito-urinary antiseptic.

Fluidextract of Matico (Fluidextractum Matico)	1.0–3.0 c.c.	m. xv–xlv

HEXAMETHYLENAMINE (UROTROPINE)

Hexamethylenamine or Urotropine is an artificial chemical substance which is used principally as a urinary antiseptic.

ACTION

Urotropine liberates formaldehyde gas in the urine. This disinfects the urine and the mucous membranes of the genito-urinary tract with which it comes in contact.

Large doses occasionally cause burning pain in the stomach, pain on urination, and the urine occasionally contains blood.

Urotropine has also been used in various septic conditions because of the formaldehyde gas which it liberates in the blood. It has frequently been injected into the spinal canal for meningitis.

Preparations

Hexamethylenamine (Urotropine) 0.2–0.6 gm. grs. iii–x

This preparation is also on the market under various names, such as **Formin, Aminoform**, etc. Other unofficial compounds of Hexamethylenamine are:

Hexal (Hexamethylenamine Salicylsulphonic Acid) 1.0 gm. gr. xv

Helmitol (Hexamethylenaminae Methylencitras) 0.6–1.0 gm. grs. x–xv

Saliformin (Hexamethylenaminae Salicylas) 0.3–2.0 gms. grs. v–xxx

METHYLENE BLUE (METHYLTHIONINAE HYDROCHLORIDUM)

Methylene blue is a chemical substance which forms a deep blue solution in water. It is used principally as a urinary antiseptic in gonorrhoea, and as a specific for malaria. It stains the urine a blue or dark green color. It is given in capsules, in doses of 0.1–0.5 gm. (grs. ii–viii).

LOCAL REMEDIES

The following remedies are used principally for the local effects which they produce. They are divided into two distinct groups:

(a) **Drugs which irritate the skin or other tissues.**

(b) **Drugs which sooth or protect the tissues.**

DRUGS WHICH IRRITATE THE SKIN OR OTHER TISSUES

POTASSIUM CHLORATE

Potassium chlorate is a white crystalline powder having a cool salty taste. The effects it produces are due to the chlorate ion of the salt.

ACTION

Applied to the skin or mucous membranes, potassium chlorate causes redness. **It relieves inflammation** of ulcerated surfaces or mucous membranes. It is frequently used as a gargle for sore throat and for ulcerations of the mouth following mercury poisoning. It increases the flow of urine, but it is seldom given for this effect, because of its poisonous action.

POISONOUS EFFECTS

Acute Potassium Chlorate Poisoning

This condition usually results when a Potassium Chlorate gargle is swallowed by mistake. The symptoms it produces are due to the formation of methaemoglobin in the blood. The blood is then unable to carry oxygen to the issues. At the same time the potassium chlorate injures the kidneys, producing symptoms of nephritis. If most of the haemoglobin in the blood has been changed to methaemoglobin, the acute form of poisoning results. If there is still some haemoglobin unchanged, the subacute form occurs.

Symptoms

1. Excessive secretion of saliva and of the mucous membranes.
2. Violent vomiting and diarrhoea.
3. Shortness of breath and cyanosis.
4. Rapid weak irregular pulse (due to the potassium).
5. Dizziness, muscular weakness, coma and death.

Subacute Poisoning

This condition results from smaller doses and produces the following symptoms:

1. Profuse vomiting and diarrhoea (the vomited matter contains bile and occasionally blood).
2. Scanty urine; which may contain haemoglobin and methaemoglobin.
3. Jaundice, and small haemorrhages into the skin.
4. Abdominal pain, delirium, convulsions and coma.

Death has occurred from heart failure in a few days, or later from uraemic symptoms.

Treatment

Wash out the stomach, give heart stimulants. The condition is best relieved by removing a quantity of blood from a vein (and thereby a quantity of the methaemoglobin) and then injecting normal salt solution into the vein.

Preparations

Potassium Chlorate 0.3–1.0 gm. grs. v–xv
(Potassii Chloras)

As a gargle it is used in 4–6% solutions.

Troches of Potassium Chlorate. Each containing 0.3 gm. (grs. v)
(Trochisci Potassii Chloratis)

Sodium Chlorate 0.3–1.0 gm. grs. v–xv

This has the same action as potassium chlorate.

MYRRH (MYRRHA)

Myrrh is a gum resin obtained from the **Commiphera**

Myrrha, an American tree. Its active principle is a volatile oil.

It reddens the skin and mucous membranes and is slightly disinfectant. It increases the secretions and is said to increase menstruation.

It is used principally as an irritant in inflammations of the gums as in mercury poisoning, and as a cathartic.

Tincture of Myrrh (Tinctura Myrrhae)	2.0–4.0 c.c.	3½–i

CHRYSAROBIN

Chrysarobin is a substance obtained from cavities in the **Andira araroba,** a tree growing in India and Brazil. Its active principle is **Chrysophanic acid.**

When applied to the skin, it causes redness, pain and even swelling. Large doses, when absorbed from the skin or when taken internally, cause nausea, vomiting, diarrhoea and scanty, bloody urine.

It is used principally in 4% ointments for the treatment of various skin diseases.

Araroba or **Goa Powder,** is the crude powder from which Chrysarobin is made.

SCARLET R (not official)

This is a chemical dye which is said to increase the formation of granulation tissue (young scar tissue). It is used for this purpose in 4–8% ointments in the treatment of wounds and ulcers.

COUNTER IRRITANTS

The following group of drugs are applied principally to the skin. They produce two kinds of effects; **local and remote.**

Local Effects

The local effects are the effects produced at the site of application, and depend upon the length of time the drug

is applied, or upon the strength of the preparation used. Thus, a weak preparation applied for a short time, produces only redness; if it is kept on for a longer time, or if a stronger preparation is used, a blister will form. A still stronger action consists in the formation of pustules, or even in the destruction of the skin (escharotic action).

Remote Effects

The remote effects produced by this group of drugs are of two kinds, **circulatory and reflex.**

The circulatory effects are due to the reddening of the skin. This brings **more blood to the surface of the skin** from the underlying or deeper tissues and organs. These tissues and organs then become anaemic. In this way, by withdrawing their excessive blood, it relieves the inflammation or congestion of the deeper organs. For example, the application of a mustard plaster to the chest will often relieve bronchitis (inflammation of the bronchi) by drawing the blood from the inflamed bronchi to the surface of the skin.

The **reflex effects** are due to the action on the nerve areas in the skin which are related to the deeper organs. For example, the application of a flaxseed poultice to the ensiform cartilage often relieves various pains in the stomach. The other reflex effects of such applications are a slight increase in the blood pressure and momentary deeper breathing; but these effects are very slight.

The counter-irritants are best classified according to the effects they produce in the usual strength in which they are commonly used, though the same effects can be obtained from all of them.

1. **Rubefacients:** Drugs that produce redness of the skin.
2. **Vesicants:** Drugs that produce blisters on the skin.
3. **Pustulants:** Drugs that produce pustules on the skin.
4. **Escharotics:** Drugs that destroy the skin.

RUBEFACIENTS

The Rubefacients are used principally to redden the skin, to relieve congestion of the underlying tissues and to relieve pain in remote organs.

Mustard: The powdered dried ripe seeds of **Brassica nigra** and **Brassica alba.** It is used in the form of a mustard plaster, or as a mustard paste made up with 4 to 5 parts of flour. For preparations and action see page 92.

Capsicum: Cayenne pepper is used in the form of a plaster. For other actions see page 76.

Oil of Turpentine: This is applied on a piece of flannel and is frequently used as a rubefacient.

Ammonia Liniment: This contains 35% of ammonia water in cotton seed oil and alcohol. It is frequently used as a rubefacient. Other substances used as rubefacients are:

Chloroform Liniment
Camphor Liniment
Sabine
Juniper

VESICANTS

Vesicants or Epispastics are drugs used to produce blisters. In this way they withdraw fluid from the deeper tissues into the blister. They are used to produce this effect in joint affections, in various inflammations of the internal organs and for neuralgic pains. They are apt to weaken the patient, and should not therefore be applied on very old patients or on infants.

CANTHARIS (CANTHARIDES)

Cantharides or Spanish fly is the dried beetle found in various temperate climates; especially in Spain and Italy. Its active principle is a neutral substance **cantharidin.**

ACTION

Applied to the skin: it causes redness and swelling with the formation of a blister. **Internally,** in small doses it increases the flow of urine. It is said to increase sexual desire.

Poisonous Effects

Absorption of cantharides from the skin, or when taken

internally in large doses, produces the following symptoms; which are due to the injury of the kidneys and alimentary tract.

1. Profuse vomiting and diarrhoea.
2. Painful, scanty urination, with scanty urine, which often contains blood.
3. Delirium, convulsions and collapse.

If it is taken in solution it causes blisters in the mouth and oesophagus, which often prevent swallowing.

The symptoms are best relieved by washing out the stomach, the administration of opium for the pain, and giving demulcent drinks.

Preparations

Cerate of Cantharides
(Ceratum Cantharidis)

Cantharides Collodion
(Collodium Cantharidatum)

Tincture of Cantharides 0.12–0.3 c.c. m. ii–v
(Tinctura Cantharidis)

Cantharides is frequently applied in the form of a plaster: a small piece of the plaster, the size of a dime is applied over the affected area.

Before applying cantharides, the skin should be shaved, cleansed with soap and water, alcohol and ether. The plaster is then applied and left on for about 4 to 8 hours, depending upon the effect desired.

Cantharis Vittata: This is the dried potato fly which contains cantharidin. It is occasionally used as a substitute for cantharides.

Strong Ammonia Water
(Aqua Ammoniae Fortior)

This is frequently used to produce blisters.

PUSTULANTS

Pustulants are drugs which produce very violent action on the skin so that a crop of pustules forms. They are not used

very frequently. The remedies which were formerly used for this purpose were **Croton Oil** and **Antimony.**

ESCHAROTICS

Escharotics or caustics are drugs which are applied locally to destroy tissues. The destroyed tissue is called the **slough** or **eschar.** The drugs of this group are used principally to destroy infected tissue such as the bite of an animal, to destroy warts and to increase the healing of ulcers. The following substances are used principally for this purpose. They have been fully described under their other more important actions.

Alkalies

Potassium Hydroxide
Sodium Hydroxide

Acids

Nitric Acid
Glacial Acetic Acid
Trichloracetic Acid
Chromic Acid

This preparation occurs in the form of dark purplish crystals which take up moisture from the atmosphere (hygroscopic).

Metals

Zinc Chloride
Corrosive Sublimate
Solution of Mercurous Nitrate
Silver Nitrate
Copper Sulphate
Alum
Bromine

DRUGS WHICH SOOTHE OR PROTECT THE TISSUES

The drugs in this group are divided into three classes.

1. **Demulcents:** Drugs which soothe the skin.

2. **Emollients:** Drugs which soften the tissues.
3. **Protectives:** Drugs which protect the skin.

DEMULCENTS

Demulcents are bland substances which are used to soothe inflamed tissues. They are also used to suspend substances which cannot otherwise be dissolved, in mixtures.

ACTION

The demulcents are all sticky substances which swell up into jelly like masses when they are dissolved in water. They prevent the tissues from coming in contact with injurious fluid or gaseous particles, and in this way they relieve the pain of inflammations and protect the tissues from injurious substances.

Preparations

ACACIA or GUM ARABIC: This is the gummy sap obtained from the **Acacia senegal,** an African tree. It contains **calcium** combined with **Arabic acid.** It is used in making emulsions of various drugs and pills.

Mucilage of Acacia 16.0. c.c. ℥iv
(Mucilago Acaciae)

This contains one part of acacia to two parts of water.

Syrup of Acacia
(Syrupus Acaciae)

TRAGACANTH: This is a gummy sap obtained from the **Astragalus gummifer,** an Oriental tree. It is principally used to suspend heavy powders in water and in the making of pills.

Mucilage of Tragacanth 16.0 c.c. ℥iv
(Mucilago Tragacanthae)

ULMUS or ELM: This is the inner bark of the **Ulmus fulva** or slippery elm tree of the United States. When mixed with

water it forms a mucilage-like substance which is very soothing to the tissues. It is often used in the form of a poultice.

Mucilage of Elm
(Mucilago Ulmi)

ALTHAEA: This is obtained from the root of **Althaea officinalis** or marshmallow.

LINUM (flaxseed or linseed). This is the dried ripe seed of **Linum usitatissimum** or the flax plant.

Flaxseed meal is the ground dried seeds and is used principally as a poultice. The seeds themselves are often given in the form of an infusion (flaxseed tea) to relieve bronchitis, painful urination and painful defecation.

SASSAFRAS MEDULLA: This is the pith of **Sassafras varifoliorum.** The mucilage of sassafras is principally used to soothe inflammations of the eye, and is occasionally given internally.

GLYCYRRHIZA or LICORICE ROOT: This is the root and underground stems of the **Glycyrrhiza glabra,** an English plant. It is used principally to soothe mucous membranes. It has a very pleasant taste because of its active glucoside **glycyrrhizin,** and it is used for this reason to flavor medicines.

Extract of Licorice Root (Extractum Glycyrrhizae)	1.0 gm.	grs. xv
Refined Extract of Licorice Root (Extractum Glycyrrhizae Purum)	1.0 gm.	grs. xv
Fluidextract of Licorice Root (Fluidextractum Glycyrrhizae)	2.0 c.c.	m. xxx
Compound Licorice Powder (Pulvis Glycyrrhizae Compositus)	2.0–8.0 gms.	ʒ½-ii

This contains senna and is used principally as a cathartic.

Troches of Licorice and Opium
(Trochisci Glycyrrhizae et Opii

Brown's Mixture (Mistura Glycyrrhizae Compositus)	15.0–30.0 c.c.	℥ss–i

These two mixtures contain opium and are used principally as soothing cough mixtures.

AMYLUM (starch): This is ordinary starch which is used in the form of a dusting powder or is boiled in water and then applied as a demulcent.

Glycerite of Starch (Plasmine)
(Glyceritum Amyli)

AMYGDALA DULCIS (Sweet Almonds). This is the seed of **Prunus amygdala dulcis** or the almond tree. It contains a fixed oil and a ferment **emulsin.** When the almonds are rubbed together with water, a bland emulsion is formed which is very soothing to the tissues.

Emulsion of Sweet Almonds	120.0 c.c.	℥iv
(Emulsum Amygdalae)		

Syrup of Sweet Almonds
(Syrupus Amygdalae)

This is a mixture of sweet and bitter almonds and contains a little prussic acid.

CHONDRUS (Irish Moss or Carragheen): This is obtained from **Chondrus crispus,** a seaweed found on the coast of Ireland and Massachusetts. It forms a jelly-like mass when dissolved in water because of a starchy substance, **carrageenin,** which it contains. Various preparations of chondrus such as **lubrichondrin,** are used as lubricants for the passage of catheters or other instruments.

KAOLINUM (Kaolin): This is a clay-like substance consisting of **Aluminium silicate.** It is used principally as a demulcent.

CATAPLASMA KAOLINI: This is a clay-like poultice consisting of boric acid, methyl salicylate, glycerine, thymol, oil of peppermint, and kaolin. It withdraws fluid from the tissues and is very soothing. It is on the market under various names; such as **Antiphlogistine, Fuller's Earth,** etc.

TALCUM: This is magnesium silicate and is used as a bland soothing dusting powder.

LYCOPODIUM: This consists of the spores of **Lycopodium clavatum** or club moss. It is used principally as a soothing dusting powder and in the making of pills.

EMOLLIENTS

Emollients are bland fatty substances used to soften the skin and as a medium for applying other drugs to the skin.

Preparations

ADEPS (Lard): This is the prepared internal fat of the abdomen of the pig. It is purified by washing, melting and straining.

Benzoinated Lard
(Adeps Benzoinatus)

Ointment
(Uguentum)

This is a mixture of lard and yellow wax and forms the basis of other ointments.

Sevum Praeparatum (Suet): This is obtained from the abdominal fat of the sheep.

Adeps Lanae Hydrosus (Wool Fat or lanolin): This is the purified fat of sheeps' wool. It takes up watery solutions easily and is readily absorbed by the skin.

PETROLATUM (Paraffins): These are substances which remain when the more volatile constituents of petroleum are distilled. They are used principally in ointments to soften the skin. Several of the paraffins which do not melt readily are used in surgery for cosmetic purposes. Some of the more fluid paraffins are used as laxatives.

Vaseline
(Petrolatum)

White Vaseline
(Petrolatum Album)

Liquid Vaseline (Albolene)
(Petrolatum Liquidum)

Paraffin
(Paraffinum)

This melts at a higher temperature and is used in surgery for cosmetic purposes.

OLIVE OIL (Oleum Olivae): This is a fixed oil obtained from the olive, the ripe fruit of **Olea Europea;** a European tree.

OLEUM LINI: The fixed oil of linseed or flaxseed.

OLEUM THEOBROMATIS (Cocoa Butter): The fixed oil expressed from the roasted cocoa bean **Theobroma cacao.** It is used principally to make suppositories.

OLEUM GOSSYPI SEMINIS (Cotton Seed Oil): The fixed oil expressed from the seeds of the cotton plant.

CETACUM (Spermaceti): This is a fatty substance obtained from the head of the sperm whale. It is used to give consistency to many ointments such as cold cream.

CERA FLAVA: The yellow wax obtained from the honeycomb of the bee.

CERA ALBA: This is white wax made by bleaching the yellow wax.

Both of these substances are used in making ointments, cerates and plasters.

CERATUM: This is a mixture of 3 parts of wax and 7 parts of lard.

GLYCERINUM (GLYCERINE)

Glycerine is a liquid made by decomposing animal or vegetable fats.

When **applied to the skin** or to a wounded surface, glycerine smarts and is painful for a few minutes, and then it softens the skin. It has the property of withdrawing fluid from the tissues (hygroscopic).

It is often given internally or it is injected into the rectum. It then produces mild movements of the bowels without any colic.

Glycerite of Starch
(Glyceritum Amyli)

Glycerin of Egg Yolk
(Glyceritum Vitelli)

There are a number of preparations of various drugs made up with glycerine. They are known as glycerites.

PROTECTIVES

Protectives are substances used to protect the tissues, to keep out infectious material, light or air.

COLLODIUM (Collodion): This is a 4% solution of pyroxilin or soluble gun cotton, in alcohol and ether. When collodion is applied to the skin, the alcohol and ether evaporate, leaving a colorless transparent contractile film, which is strongly adherent to the skin and protects it.

Collodion
(Collodium)

Flexible Collodion
(Collodium Flexile)

This contains Canada turpentine and castor oil in addition to the other ingredients, and is more pliable.

Styptic Collodion
(Collodium Stypticum)

This contains 20% of tannic acid and is therefore astringent.

ELASTICA (India Rubber or Caoutchouc): The dried milky juice of a Brazilian tree. It is known as Para rubber. It is used in making adhesive plaster, bougies, etc.

CALCII SULPHAS EXSICCATUS: This is dried gypsum or **plaster of Paris.** When dissolved in water it forms a thick gelatinous mass which becomes hard when exposed to the air. It is used alone or with bandages soaked in it.

CHAPTER XXIII

SERUMS, VACCINES AND ORGANIC SUBSTANCES

SERUMS

When a patient suffers from an infectious disease, and then recovers, the disease is overcome (the patient is immunized) by the formation in the blood of antibodies (antidotes) for the cause of that particular infection. The production of such antibodies in the blood of the patient is called **active immunization.** Similarly, when an animal is injected with bacteria or their poisonous excretions (toxins) in gradually increasing doses, the animal becomes actively immune against the injected bacteria or their toxins. The **serum** of that animal can then be injected into patients suffering from a similar infection, to overcome the infection. The patient then becomes immunized against this particular disease. The production of such immunity is called **passive immunity,** since the antibodies have been formed by another animal.

A serum is the serum of an animal that has been immunized against a particular bacterium or its toxins. Serums are of two kinds: **Bacteriolytic,** and **Antitoxic.**

BACTERIOLYTIC SERUMS

A bacteriolytic serum is the serum of an animal that has been immunized against a particular bacterium. The horse is the animal commonly used for the manufacture of serums since the largest quantity of serum can be obtained from this animal.

Method of Manufacture

A horse is injected with a small dose of a solution of the

particular bacterium against which the serum is desired. The horse then becomes ill and has a rise of temperature, which disappears in a few days. When the animal is well again, the injection is repeated, but with a larger dose; which now does not produce such severe symptoms.

The injections are repeated until the animal can stand injections of large doses of the bacteria without any symptoms being produced. The horse is then immune against that particular bacterium, and his serum contains antibodies (antidotes) against the bacteria with which he was injected. The animal is then bled from the Jugular vein, the blood is allowed to clot, and the serum is removed under strictly aseptic precautions. This serum, when injected into patients suffering from an infection produced by the same bacteria, neutralizes their poisonous effects; the antibodies of the serum combining with the bacteria.

Preparations

Antistreptococcus Serum

This serum is used in the treatment of septicaemia, erysipelas, scarlet fever. It is made by immunizing horses against Streptococci.

Polyvalent Antistreptococcus Serum

This is made by immunizing horses against several different strains of Streptococci.

Antistaphylococcus Serum

This is made by immunizing horses against dead Staphylococci. It is used in the treatment of sepsis caused by Staphylococci.

Antipneumococcus Serum

This is the serum obtained by immunizing horses against dead and living Pneumococci. It is used in the treatment of pneumonia.

Antigonococcus Serum

This is the serum of rams immunized against dead and

living Gonococci. It is especially valuable in the treatment of gonorrhoeal joints.

Antidysenteric Serum

This is the serum of horses immunized against the dysentery bacillus (Shiga bacillus).

Antimeningococcus Serum

This is the serum of horses immunized against dead and living Meningococci. It is injected in 15–30 c.c. doses into the spinal canal, after the same amount of fluid has been withdrawn from the canal.

Antityphoid Serum

This is the serum of horses injected with dead cultures of typhoid bacilli.

ANTITOXIC SERUMS

An antitoxic serum is the serum of an animal that has been immunized against the poisonous excretions (toxins) of a bacterium, but not against the bodies of the bacteria themselves.

Antitoxic serums are prepared in the same way as antibacterial serums but the animal is repeatedly injected with a filtrate of a bouillon culture of the bacteria, passed through a Berkefeld filter. This filtrate contains only the toxins of the bacteria, but not their bodies.

Preparations

Diphtheria Antitoxin Serum

This is the serum of a horse that has been immunized against the toxin of the diphtheria bacilli. It contains antibodies against the diphtheria toxin. When the serum is injected into a patient suffering with diphtheria, the antibodies combine with the diphtheria toxin, thereby neutralizing the symptoms of the disease.

Diphtheria antitoxin is the most efficient serum which is used at the present time. The disappearance of the membrane in the throat, and the clearing up of all the toxic symptoms result in one to two days after the injection.

It is usually given in doses of 5000 to 10000 units (an antitoxic unit is the amount of antitoxin that will immunize a guinea pig weighing 250 gms. against 100 times the fatal dose of diphtheria toxin). It should be repeated every 12 hours until all the symptoms disappear. It should always be given early in the disease. In the later stages the toxin may have already combined with the nerve cells and complications may then result; but no case is hopeless.

Diphtheria antitoxin is also given in doses of 500 to 1000 units to those who are exposed to diphtheria cases to prevent them from contracting the disease (immunizing).

Diphtheria Antitoxin (Concentrated)
Refined Diphtheria Antitoxin
(Antidiphtheritic Globulins)

These are all specially prepared antitoxins from which some of the inactive serum albumins have been removed, so that smaller quantities of serum may be used to produce the same effects.

Tetanus Antitoxin

This is the serum of a horse that has been immunized against the toxins of the Tetanus bacilli.

It is given in doses of 3000 to 20000 units every 4 to 8 hours. As an immunizing dose about 1500 units are given.

BACTERIAL VACCINES

Bacterial vaccines are solutions of dead bacteria in normal salt solution. A ½% carbolic acid solution is usually added as a preservative.

They are used to immunize patients against infections caused by the same kind of organisms as those that are injected. There are two kinds of vaccines: Autogenous vaccines and stock vaccines.

Autogenous vaccines are solutions of bacteria, obtained from the patient who is being treated.

Stock vaccines are solutions of bacteria obtained from other sources.

The principle upon which the action of vaccines is based, is the following: The injection of the dead bacteria into the patient, causes the formation, in the serum of the blood, of a substance which excites the phagocytic action (destructive action) of the white blood corpuscles, so that they take up and destroy the bacteria of the blood more readily.

The substances formed in the serum by the dead bacteria, which increase the phagocytic action of the white blood corpuscles, are called opsonins.

Preparations

Staphylococcus Vaccine

This is a solution of dead Staphylococci and is used in the treatment of acne, furuncles and other Staphylococcus infections.

Streptococcus Vaccine

This is a solution of dead Streptococci in salt solution. It is used in treating Streptococcus infections.

Typhoid Vaccine

This is a solution of dead typhoid bacilli in salt solution. It is injected into patients to prevent them from contracting typhoid fever when they are exposed to that disease (immunizing them against typhoid).

Gonococcus Vaccine

This is a solution of dead Gonococci in normal salt solution and is used principally in the treatment of gonorrhoeal joints.

Bacillus Coli Vaccine

This is a solution of dead colon bacilli in normal salt solution.

Pneumococcus Vaccine

This is a solution of dead Pneumococci in normal salt solution.

Coley's Serum

This is a mixture of Bacillus prodigiosus and Streptococci, which is used in the treatment of sarcoma.

Lactic Acid Bacilli

A number of bacilli which sour milk by the formation of lactic acid, have recently been used very extensively in medicine. The most important organism of the group is the **Bacillus bulgaricus.** The presence of these harmless bacilli in the intestines, and their formation of lactic acid, prevents the growth of other harmful bacteria which cause intestinal fermentation and putrefaction. Cultures of these bacilli, in solid or liquid form are therefore given to lessen intestinal fermentation and to relieve various symptoms resulting from this condition. Recently, these cultures have been used with considerable success in the treatment of diabetes.

Solid Preparations

Bulgara Tablets 2 tablets

A pure culture of Bacillus bulgaricus.

Lactic Bacillary Tablets 1–2 tablets

Fluid Preparations

Massolin

This is a pure culture of Bacillus bulgaricus of Massol, grown in broth to which calcium salts have been added. It is often applied to the throat after an attack of diphtheria when the bacilli are still present.

Lactampoule and a number of other preparations.

There are a number of preparations of milk on the market containing bulgaric bacilli such as **Fer mil lac, bacillac, zoolak,** etc.

OTHER SERUMS

Old Tuberculin

This is a solution obtained by filtering a bouillon culture of living tubercle bacilli through a Berkefeld filter and adding a little glycerine to it as a preservative. It contains the toxins of the tubercle bacilli. It is now only used to diagnose tuberculosis, either by injection, which causes a rise of temperature, or by the application to the skin.

New Tuberculin

This is made by grinding up tubercle bacilli and mixing them with equal parts of water and glycerine.

Vaccine Virus

This is the pus obtained from the pustules of calves suffering with cow pox. The pus is obtained under sterile precautions and a little glycerine is added as a preservative. It is used for vaccination against small pox.

The principle of vaccination depends on the fact that an individual who has had an attack of cow pox, becomes immune against small pox. Vaccination produces a mild attack of cow pox at the site of the application of the virus. This makes the patient immune against small pox.

Antirabic Vaccine

This is an emulsion of the spinal cords of rabbits who have been inoculated with rabies (hydrophobia) poison. After the animals have been inoculated, they are killed and their spinal cords removed. The cords are dried, ground and made into an emulsion in normal salt solution. This emulsion is used in the treatment and prevention of hydrophobia. The treatment is begun with the injection of a weak emulsion of a cord which has been dried for a long time, and is followed by the injection of stronger emulsions (containing cords which have been dried for a shorter time.)

Normal Horse Serum

This is ordinary serum obtained by coagulating horses' blood, and removing the serum. It is injected into patients to increase the clotting of the blood.

Leucocyte Extract

This is a fluid made by injecting **aleuronat** (diabetic flour) into the chests of rabbits. This forms a thick fluid (exudate) which contains a large number of white blood corpuscles. It is used in 10.0 c.c. doses in the treatment of pneumonia.

Nuclein 0.3–0.6 gm. grs. v–x

This is a compound of phosphorus and proteids which is said to increase the number of white blood corpuscles and thereby to destroy bacteria.

ORGANIC REMEDIES

The following substances are obtained from various organs of animals. They are used in the treatment of diseases due to deficient secretion of similar organs in the body.

THYROID EXTRACT

Thyroid extract is a powder made by grinding up the thyroid glands of sheep. Its active principle is a substance called **iodothyrin.**

ACTION

The thyroid gland is a ductless gland which secretes a substance into the blood. This substance regulates the growth and development of the body. Thus, children who have a poorly developed thyroid gland, are stunted in their growth, they develop pads of fat in the neck and other parts of the body, their intelligence is lessened, and they are dull and stupid (Cretinism).

The administration of thyroid extract to such children is followed by startling improvement of their intelligence, growth and development.

Old people in whom the thyroid gland has atrophied, so that its secretion is very much lessened, often suffer from similar symptoms; such as dullness of mind and drowsiness (myxoedema).

These symptoms are relieved by the administration of thyroid extract.

Poisonous Effects

" Hyperthyroidism "

When the thyroid gland secretes more substances in the blood than is necessary, the following symptoms are produced: These symptoms frequently occur from certain enlargements of the thyroid gland (Exophthalmic goitre or Graves' disease).

1. Rapid loss of weight.
2. Rapid, thready pulse.
3. Nervousness.
4. Bulging eyeballs (exophthalmos).
5. Diarrhoea.

Thyroid extract is frequently taken to reduce weight in obesity. It is a dangerous remedy, as its continued use often produces the symptoms of hyperthyroidism.

Thyroid Extract (Glandulae Thyroidae Siccae)	0.2–0.6 gm.	grs. iii–x
Antithyroidin Moebius	0.5–1.0 c.c. m.	viii–xv

This is the serum of goats in whom the thyroid glands have been removed about six weeks before the serum is removed. It is used in the treatment of exophthalmic goitre (excessive thyroid secretion).

Other Organic Substances

Ovarian Extract	0.06–0.2 gm.	grs. i–iii

This is a powder made from the fresh ovaries of pigs. It is used to relieve the symptoms of the artificial menopause, which follow the complete removal of both ovaries: such as flushes of the face and nervousness. These symptoms result from the absence of the internal secretion of the ovaries.

Lutein

This is a substance made from the corpus luteum of the ovaries of the cow. It is used to relieve painful and scanty menstruation and the nervous symptoms usually associated with this condition.

Pituitary Extract

This is a substance made from the pituitary gland of the ox. It is a small gland situated at the base of the brain.

The posterior lobe of this gland secretes a substance into the blood which contracts the blood vessels and the uterus.

Disturbed secretion of this lobe produces a peculiar group of symptoms, such as the change in some of the sexual characteristics of the individual. (Hypopituitarism.)

Disturbed secretion of the anterior lobe causes enlargements of the hands and features, known as **acromegaly.**

Dessicated Pituitary Substance (anterior lobe) 0.06–0.3 gm. grs.i–v

This is used in the treatment of acromegaly.

Dessicated Pituitary gland (posterior lobe) 0.06–0.3 gm. grs. i–v

This is used in the treatment of hypopituitarism.

Pituitary Body Dessicated 0.06–0.3 gm. grs. i–v

Pituitrin

These substances are used to increase uterine contractions.

Thymus

Thymus is a powder made from the fresh thymus of the calf. It is a gland situated in the chest behind the sternum and probably regulates the growth of the child. It is used in the treatment of rheumatism and rickets.

SWEETENING SUBSTANCES

Saccharin (Benzosulphinidum): This is a chemical substance having a very sweet taste. It is 200 times sweeter than sugar and is used to sweeten foods for diabetic patients who cannot take sugar. It is usually given in 0.03 gm. (gr. ½) doses together with 0.3 gm. (grs. v) of sodium bicarbonate, since it dissolves more readily in alkaline solutions.

Saccharum Lactis (Milk Sugar): used to flavor substances and to give consistency to powders.

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It should be pointed out that for the purposes of this work Sir Edward Cook has had access to the family papers, and has therefore been able to prepare the first full and authentic record of Florence Nightingale's character and career. The volumes are rendered additionally attractive by the inclusion of several interesting portraits.

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