

Hale-White's
MATERIA MEDICA
PHARMACOLOGY AND
THERAPEUTICS

THIRTY-SECOND EDITION

BY

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PREFACE TO THIRTY-SECOND EDITION

The move from empiricism to rational therapeutics, made possible by the work of research chemists in the last three decades, is nearly complete. The development which has been reflected in successive editions of this book is now accompanied by elimination of the anachronistic Imperial System of weights and measures; a step forecast in the preface to the thirty-first edition. For the older generation of prescribers, who may still think in terms of the pre-sulphonamide era, a quick reference to metric equivalents and temperature conversion has been provided on the book-mark.

Latin titles have also been omitted. The Latinization of the names of modern drugs serves no useful purpose. Furthermore, English has the greater claim to being the international language of science. Finally, the cult of secrecy in prescribing, ostensibly favoured by the use of Latin, is no longer in vogue.

It is hoped that this departure from tradition, which has accompanied a complete revision, will find favour with the readers.

I am most grateful to my colleague, Dr. P. M. F. Bishop, who writes the section "Hormone Preparations, Part I"; and, to Dr. Roy Goulding, Director of the National Poisons Centre, Guy's Hospital, for his generous help in the task of revision.

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DEFINITIONS

THE term **Materia Medica** is applied to the study of the characters of natural and synthetic drugs and embraces **Pharmacognosy**, *i.e.* the knowledge of the natural history, physical characters, and chemical properties of drugs, and **Pharmacy**, which is the science and art of the preparation and combination of drugs.

A **drug** is any substance or preparation for internal or external use for the cure, mitigation, or prevention of disease.

Pharmacology is the science which treats of the actions of drugs on the body both in health and disease. The science which studies the effects of doses large enough to endanger life is **Toxicology**.

Therapeutics is the science and art of alleviating or curing disease.

A **Pharmacopœia** is a book published by some authorized body, generally constituted by law. This book describes most of the drugs in common use, with directions for their preparation, identification, standardization, and dosage. The pharmacopœias and the authorities publishing them differ in different countries. The **British Pharmacopœia (B.P.)** is published by the General Medical Council. The last appeared in 1958. As new drugs are discovered they are, if of sufficient use, included in new editions of the **Pharmacopœia** or in **Addenda** published from time to time. Everything contained in the **Pharmacopœia** is said to be "official." The General Medical Council has also adopted the practice of recognizing as **Approved Names** certain non-proprietary names which will eventually be used as the **B.P.** name should the drug be ultimately included in that compilation. This is a great help in respect of drugs bearing many proprietary names (*Tr. name*). Although used in this work, they are not specially marked.

The Council of the Pharmaceutical Society of Great Britain publish **The British Pharmaceutical Codex (B.P.C.)**, containing many preparations not in the **British Pharmacopœia**. The last appeared in 1954.

A joint committee representing the British Medical Association and the Joint Committee on a National Pharmaceutical Service have produced through a representative committee a **National Formulary (N.F.)**.

PHARMACY

Pharmacy is for the most part carried out by the manufacturing and dispensing chemist. The medical student should, however, be acquainted with the simpler processes which are best learnt in the dispensary. An elementary knowledge of chemistry will enable him to understand most of the terms used in pharmacy, but the following should be noticed.

Alkaloids are bodies having the following characteristics:

1. They are the active nitrogenous principles of organic bodies.
2. They are compound ammonias; that is to say, one or more atoms of hydrogen in ammonia (NH_3) are replaced by various radicals.
3. They combine with acids to form crystalline salts without the production of water.
4. They are alkaline, turning red litmus paper blue.
5. A few are liquid, such as pilocarpine, coniine, nicotine, sparteine, lobeline. Liquid alkaloids nearly always contain only carbon, hydrogen, and nitrogen.
6. The solid ones are colourless, crystalline, and contain oxygen.
7. They are sparingly soluble in water, readily so in alcohol. Their salts are usually soluble in water.
8. The solutions of many are intensely bitter.
9. Most of them are closely related to pyridine, and some may be synthetically prepared from pyridine bases.

Names of alkaloids terminate in English in *-ine* (quinine). Example in B.P.: Atropine.

Glycosides are crystalline bodies which when acted upon by acids, or chemical ferments, split up into sugar and other substances—aglucones, *e.g.* alcohols, aldehydes, or phenols. If the sugar fraction is glucose the glycoside is known as a glucoside. Many glycosides contain carbon, hydrogen and oxygen only: a few have also nitrogen and sulphur.

Example in B.P.: Digoxin.

Saponins are a group of glycosides forming a clear solution in water, which froths on shaking, and may be used to emulsify oils and resins. Senega contains a powerful saponin.

Fixed Oils are obtained from the fruits or seeds of plants, or from animal tissues. When pure they usually are yellow and float on water; they cause a greasy mark on paper. They are called *fixed* because they cannot be distilled without decomposition. They are soluble in ether or chloroform.

They are ethereal salts formed from the higher fatty acids and the trihydric alcohol glycerin, $C_3H_5(OH)_3$. At ordinary temperatures they remain liquid. The usual fatty acids entering into the composition of fixed oils are oleic, palmitic, and stearic.

Example in B.P.: Almond Oil.

Fats are fixed oils which are solid at ordinary temperatures.

Example in B.P.: Theobroma Oil.

Waxes are chiefly composed of fatty acids combined with monohydric alcohols homologous with methyl alcohol.

Volatile or Essential Oils resemble fixed oils only in being soluble in the same media. They do not leave a greasy mark on paper. They are mostly inflammable. They are highly aromatic, and sufficiently soluble in water to impart their odour and taste to it. Most are prepared by distillation. They consist of hydrocarbons, $C_{10}H_{16}$, known as terpenes.

Example in B.P.: Dill Oil.

Resins are among the products of oxidization of volatile oils. They are soluble in alkalies, forming resin soaps. They are insoluble in water but not in alcohol, therefore they may be prepared by extraction with alcohol and precipitation with water.

Example in B.P.: Colophony.

Oleo-resins are natural solutions of resins in volatile oils.

In B.P.C.: Copaiba.

Balsams are mixtures of oleo-resins with benzoic acid or cinnamic acid, or with both.

Example in B.P.: Benzoin.

Gums are exudations from plants and are composed of carbohydrate ($C_6H_{10}O_5$)_x and related to starch and cellulose.

Gum-resins are exudations from plants consisting of a mixture of gums and resins. Myrrh is an example.

Chelating Agents. These are substances which will inactivate ions, usually metallic, by drawing them into a ring structure in the molecule. The name is derived from *Chela*, a prehensile claw. The best examples are dimercaprol (B.A.L.) and sodium calciumedetate (E.D.T.A.), used in cases of poisoning to inactivate arsenic and lead respectively.

PHARMACEUTICAL PROCESSES

Many of these, as filtration, precipitation, &c., need no explanation, but the following require a few words:

Elutriation consists in diffusing an insoluble powder in water, letting the heavier part settle, then decanting the supernatant fluid. The heavier powder in this is allowed to settle, the fluid decanted, and so on until a fluid containing powder of the required fineness is obtained.

Levigation consists in reducing a drug to a very fine powder by triturating it with a little water and drying the resulting paste.

Lixiviation consists in the extraction with water of the soluble matter of the ashes of anything which has been ignited, the solution being called a "lye."

Maceration consists in leaving coarsely powdered solid organic substances in contact for some time, at the temperature of the atmosphere, with a liquid in a vessel which is frequently agitated. The resulting solution is poured off and added to the liquid obtained from the remaining substance by pressure.

Percolation is a process for obtaining the soluble constituents of a drug by the descent of a solvent through it. The percolating fluid, or **menstruum**, is poured on to the drug and allowed to macerate for a time. The percolate is then collected. The **Marc** is the material after its exhaustion by maceration or percolation.

Repercolation consists in using the liquid obtained by percolating a substance as the menstruum for percolating a second portion of the same substance, and so on as often as may be desired.

Scaling. Scale preparations are made by drying concentrated solutions of drugs on glass plates. The solid left behind forms a thin film on the plate, and this film is broken up. Some preparations of iron are scale preparations.

Standardizing. The Pharmacopœia directs that certain preparations made from drugs shall be standardized—that is to say, shall be made to contain a certain fixed proportion of the chief active principle, *e.g.* Opium must contain not less than 9.5 per cent. of Morphine.

Biological Assay. When a drug is a definite chemical body, *e.g.* morphine in opium, preparations of it can be standardized by chemical means; but when its activity is due to a body or bodies which the chemist cannot estimate quantitatively, the attempt is made to determine the strength of its preparations by observing the minimum fatal dose of each, when administered under similar conditions, to animals of the same species and weight. Or the drug may be standardized by observation of the degree of some striking physiological effect, *e.g.* preparations of pituitary extract may be standardized by observing their effect on the guinea-pig uterus.

WEIGHTS, MEASURES, SYMBOLS

Imperial System

WEIGHTS (Apothecary)

Name	Symbol	Equivalent
Grain	gr.	
Drachm	$\frac{3}{4}$	60 grains.
Ounce	$\frac{3}{4}$	480 grains, 8 drachms.

WEIGHTS (Avoirdupois)

Name	Symbol	Equivalent
Grain	gr.	
Ounce	oz.	437.5 grains.
Pound	lb.	7000 grains, 16 ounces.

CAPACITY

Name	Symbol	Equivalent
Minim	℥	
Fluid drachm	℥	60 minims.
Fluid ounce	℥	480 minims, 8 fluid drachms.
Pint.	⊙	20 fluid ounces.

Occasionally $\overline{3}$ and $\overline{3}$ are written $f\overline{3}$ and $f\overline{3}$ when they stand for fluid drachms and fluid ounces.

The sign $\overline{3}$ is sometimes used to represent oz. (437.5 gr.), but this is much to be deprecated.

Percentage Solutions. The expression "per cent." is used in one of the three following meanings:

Per cent. w/w	= weight in weight.
" " v/v	= volume in volume.
" " w/v	= weight in volume.

In the pharmacopœial description of the various proportions which several parts of a compound bear to one another, the word *parts* means parts by weight; the term *fluid parts* signifies the volume of an equal number of parts of water.

Metric System. This is official on the Continent and in the B.P. for the making of drugs and preparations and for doses.

N.B. The Pharmacopœia indicates dosage in grammes or fractions of a gramme. Quantities less than 0.1 G. are expressed as milligrams or fractions of a milligram. Fluid measures are in multiples or fractions of a millilitre.

WEIGHTS

1 microgram ($\mu\text{g.}$) or (mcg.)	= 0.000001 G.
1 milligram (mg.)	= 0.001 G.
1 gramme (G.)	= weight of 1 millilitre or ml. of distilled water.

The symbol for gramme may also be written as g., but to avoid confusion with gr., the capital G. is to be preferred.

MEASURES OF CAPACITY

1 litre = the vol. at 4° C. of 1000 G. (1 kilo.) of water.

N.B. 1 cubic centimetre (abbrev. c.c.) is approximately the same as one millilitre.

Approximate Equivalents Imperial and Metric
(Based on the B P. Sufficiently accurate for *prescribing*)

WEIGHTS

Imperial Grains		Metric Milligrams	Grains		Grammes
$\frac{1}{100}$	.	0.3	15	.	1
$\frac{1}{100}$	.	0.6	45	.	3
$\frac{1}{80}$	.	1	60	(1 drachm)	4
$\frac{1}{60}$	.	2	150	.	10
$\frac{1}{48}$	.	4	180	.	12
$\frac{1}{32}$	.	10	240	($\frac{1}{2}$ oz.)	16
1	.	60			

VOLUMES

Minims		Ml.	Fluid drachms		Ml.
$\frac{1}{2}$	.	0.03	$\frac{1}{2}$	.	2
1	.	0.06	1	.	4
5	.	0.3	2	.	8
15	.	1	5	.	24
30	.	2	Fluid ounces		Ml.
60	.	4	$\frac{1}{2}$	.	15
90	.	6	1	.	30
			Pint		
			1	.	568

Domestic Measures

These should not be used for preparations containing powerful drugs because the measure is too variable. A graduated measuring glass should be used.

A TEASPOONFUL is rather over 4 ml.

A DESSERTSPOONFUL is about 8 ml.

A TABLESPOONFUL is about 15 ml.

A TUMBLERFUL is about 330 ml.

A DROP is often taken as being about 0.1 ml., but drops vary so much in size that they should never be used for children nor as a measure of powerful drugs.

Temperature Fahrenheit	Conversion Centigrade
96	35.6
97	36.1
98.4	36.9
100	37.8
101	38.4
102	38.9
104	40.0

PHARMACOPŒIAL PREPARATIONS

Most drugs are not, in their natural state, fit for administration. They are either too bulky, too nauseous, or contain noxious principles. Preparations suitable for administration are therefore prepared from them according to "official" pharmacopœial directions. The Pharmacopœia states the doses of the various drugs and their preparations which may safely be given to an adult, but these doses are often not rigorously kept in prescribing. They vary with the purpose for which the drug is required and the age of the patient (*see* Prescribing). The following is a brief description of pharmacopœial preparations.

Applications. These are liquid preparations applied to the skin for superficial or repellent action. The official one contains benzyl benzoate to treat parasitic infestation.

Aromatic Waters. These are aqueous fluids impregnated with some aromatic substance, usually a volatile oil.

Distilled Water.

Capsules are shells made of gelatin and glycerin to contain a medicament. The shell is soluble in water at 37° C.

Collodia are solutions of pyroxylin. When applied externally a protective film is formed owing to the rapid volatilization of the solvent.

Creams are preparations having wax, glycerin, soft paraffin, or some similar substance as a basis, and used for external application.

Emulsions. An emulsion consists of two liquid phases, one of which is subdivided finely and dispersed in the other, the system being made more or less permanent by an emulsifying agent.

Extracts. Concentrated preparations obtained by separating the soluble matter from vegetable or animal tissues by means of water, alcohol, or some other suitable solvent. The liquid so obtained is concentrated by evaporation to make a Liquid Extract, or evaporated to dryness, or nearly to dryness to form a Solid Extract. Solid extracts may be dry powders or soft viscous masses known as Soft Extracts.

Glycerins. Solutions of drugs in glycerin.

Infusions. Concentrated infusions are made by treating the substance to be extracted with alcohol and water. Infusions are prepared from these by the addition of distilled water. The former are relatively stable; the latter should be dispensed within twelve hours of preparation.

Injections. These are preparations suitable for parenteral administration.

Liniments. Liniments or embrocations are applications of an oily or spirituous consistence, all of which are intended to be rubbed into the skin. Most contain camphor, some contain olive oil, most contain alcohol.

Liquors or Solutions. Solutions generally of definite chemical bodies, and in which the solvent is usually distilled water or alcohol. In many cases these are the only constituents. The few exceptions can be found by reference to individual Solutions.

Lotions. Aqueous mixtures for external use, generally applied on lint, or washed on the part.

Mixtures. Liquid preparations consisting of more than one drug dissolved in water or diffused in some thick fluid. The mixture is usually flavoured, and is for internal administration.

Mucilages are aqueous, viscid solutions or partial solutions of gum used for suspending insoluble substances.

Ointments for the eye (oculenta) made by the incorporation of the drug in a mixture of yellow soft paraffin and wool fat.

Oils. The oils in the Pharmacopœia are obtained by distillation or by expression.

Pastes. Pastes contain zinc oxide and paraffin and one or more active ingredients for external application.

Pills. Solid spherical bodies containing medicinal agents, and intended to be swallowed whole. In order that they may not possess a disagreeable taste, they are often varnished or sugar-coated. Unless the constituents are very heavy, each pill should not exceed 0.3G. in weight. All pills are useless unless so made that they will dissolve in the gastro-intestinal canal. If it is required that they should not be acted upon until they reach the intestine, they should be coated with keratin.

Powders. Simple powders prepared with pulverized crude drugs.

Compound Powders. Mixtures of two or more finely powdered drugs.

Dusting Powders. Inert and protective.

Spirits. Spirits are either simple or complex. Simple Spirits are solutions in alcohol of—

- (a) A volatile oil,
- or (b) camphor,
- or (c) chloroform,
- or (d) ether,
- or (e) wood naphtha.

Complex Spirits are of varying composition. They are prepared by distillation.

NOTE.—Sp. is in English a common abbreviation for Spirit. In French it is the abbreviation for Syrup.

Sponges are made of porous material and are used for their absorbent action.

Syrup. Syrups are saturated or nearly saturated solutions of sugar containing flavouring, colouring or therapeutically active substances.

Tablets are solid discs prepared by compressing or moulding a drug, or a mixture of drugs.

Tinctures are solutions of the active principles of drugs in alcohol. They are closely allied to spirits, from which most of them differ in their mode of preparation. They are prepared by—

- (a) Maceration.
- (b) Percolation.
- (c) Dilution of some more concentrated preparation.

The term tincture is no longer applied to simple alcoholic solutions of chemical substances, and for this reason the familiar tinctures of iodine are now to be found under Solutions.

Ointments (unguenta) are semi-solid preparations consisting of a fatty substance mixed with an active drug. They are intended only for external use. The basis may be either soft paraffin, lard or wool-fat, sometimes combined with hard paraffin, wax, olive oil, or spermaceti.

Benzoinated lard is often used, as it is less liable to turn rancid than plain lard.

The drug, if insoluble in the base, should be in the finest possible state of division and be evenly distributed throughout.

In hot countries if the ointment would otherwise be too soft, the basis may be replaced by benzoinated lard, prepared suet, yellow beeswax, or white beeswax.

The following NON-PHARMACOPŒIAL PREPARATIONS are used:

Ampoules. Glass containers for solutions intended for injection.

Bougies are solid cylinders impregnated with various drugs, and used for introduction into the ear (called aurinaria), nose (called buginaria), or urethra. They are made either of gelatin (to be dipped in warm water before use) or oil of theobroma (to be dipped in oil before use). Those for the urethra are made in six sizes, varying from $\frac{1}{8}$ to $\frac{1}{16}$ inch in diameter.

Cachets, made of wafer paper, consist of two watch-glass-shaped halves. The drug is enclosed between them, and they adhere when moistened. The cachet is slightly moistened, put in the back of the mouth, and quickly washed down with a little

water. This is an excellent way of giving drugs which are either nauseous or difficult of solution or suspension.

Collunaria. Fluids used as nasal douches.

Collyria. Fluids used as eye washes, isotonic with lachrymal secretion.

Confections (Syn. electuaries, boluses, conserves). Powders made into a paste with sugar or honey, of such a consistency that the powder does not separate, but the mass can be swallowed.

Discs (lamellæ). Small thin discs made with gelatin and glycerin, and used to drop into the eye.

Draught (Haustus). This term is used when only a single dose of a fluid preparation is required.

Drops. Fluid preparations to be dropped into the eye or nose.

Effervescent granules consist of citric and tartaric acids and sodium bicarbonate for purposes of effervescence when introduced into water. To these constituents is added the main pharmacological principle.

Enemas (clysters). Liquid preparations intended for injection into the rectum. When their object is to empty the bowel they are large in bulk (300 to 600 ml.); when it is wished that they should be retained they are usually smaller in bulk.

Essences. Solutions of volatile oils in rectified spirit, usually of a strength of 1 in 5.

Fomentations consist of flannels wrung out in hot water, to which drugs may or may not have been added.

Gargles. Aqueous solutions used for gargling.

Inhalations are preparations arranged for the inhalation of volatile drugs.

Insufflations. Powders for blowing into the throat and larynx.

Linctus. A linctus has honey, treacle, or some other thick substance as a basis. It is to be swallowed slowly, being retained some time in the mouth.

Lozenges or Troches are small flattened cakes prepared from a basis of sugar and acacia, suitably flavoured and combined with medicaments usually intended for a prolonged local action on the mucous surfaces of the mouth and throat. They should be sucked slowly.

Paints are liquid preparations suitable for application to the skin or mucous membranes by means of a brush.

Pastils are lozenges having glyco-gelatin as a basis used for applying medicaments to the throat and mouth.