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Scope of Study: Increase in the use of drugs has been phenomenal, yet popular knowledge concerning those drugs has enlarged very little. This is true even though experts agree that there are potential dangers connected with many known drugs and even though in recent years much greater emphasis has been placed on a properly balanced diet. This report is a summary of a few major facts about drugs, facts which should give the ordinary high school teacher a starting point in the presentation of the origins, structures, effects and dangers of the drugs used today. Although the sources of drugs are discussed, most attention has been given to some general classifications of common drugs with a consideration of their uses and effects.

Findings and Conclusions: A thorough understanding of drugs and their uses must be left to the expert who alone has the background to investigate the many aspects of drug sources, chemical structures, and physiological effects. The dangers inherent in many drugs, however, and the need for intelligent understanding of the materials taken into the body is sufficient reason for all persons having some knowledge of drugs. Since the home will likely not supply this information, the school must. With a few general principles and some facts available, the high school teacher can do much toward enlightening the future generation in regards to its own welfare with respect to drugs.

ADVISER'S APPROVAL James H. Zant

SECONDARY SCHOOL TEACHER RESOURCE MATERIALS

FOR A UNIT ON DRUGS

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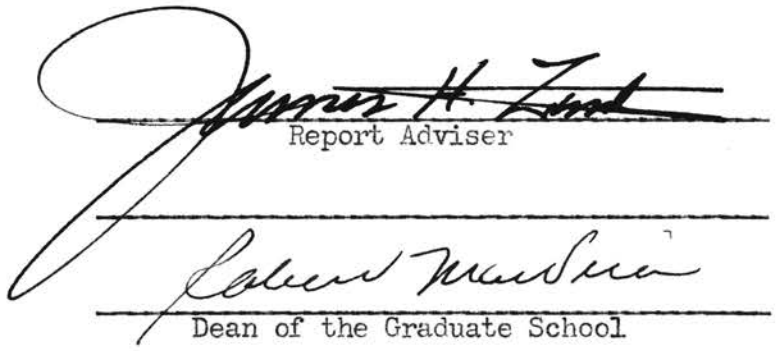

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CHAPTER I

THE PROBLEM

The Problem Stated

It is evident that although almost every person in the United States has constant association with drugs in one form or another, the average youth leaves high school or even college with very little knowledge about them. This is unfortunate in the light of the fact that the human resources of a nation are by far the most valuable and if these resources are to be conserved, reliance upon experts must be coupled with some intelligent understanding and appraisal of the foods we eat and of the drugs we take.

Because of the renewed emphasis placed upon good health in relation to the common good, it would certainly seem obvious that a general study of drugs and the part they play in the formation and maintenance of good health should form a vital part of the terminal high school curriculum.

Purpose of this Study

It was the purpose of this study, therefore, to present a rather concise but general guide which could serve as teacher resource material in the teaching about drugs on the high school level. Since it has been assumed that but few teachers have specific training in this area, there has been an attempt to herein build up a background of information about

drugs sufficient for the teacher to proceed to further studies in the areas that he may choose.

Limitation of this Study

This study is limited by several factors. First, since the literature relative to drugs is so voluminous, there is no intent to thoroughly investigate one limited area but rather to survey the whole field in the light of the stated purpose--high school teacher resource material. Secondly, in order to limit the area of study so that adequate treatment could be given to the ideas presented, it has been necessary to choose a few topics out of many related to the problem. Therefore, this paper only purports to outline a possible approach to the study of drugs. A few topics such as vitamin drugs, allergy drugs, and drugs from radioactive isotopes have been completely ignored either because they are often referred to in high school textbooks or because of space limitations. Thirdly, because it is likely that most teachers who will use this guide will have only a layman's knowledge of drugs and because they are called upon to interpret the knowledge they do assimilate to youth, a non-technical approach has been followed. To gain a practical understanding of drugs, it is necessary to have some knowledge of their use, hence a fourth limitation is that this paper has necessarily said less about the drugs themselves in order to have space to indicate their use and effects on the human body.

Review of the Literature

In general, this study has been based predominately upon elementary literature in this field of study. A variety of textbooks on

pharmacology have been surveyed as well as many books and articles devoted to some specific area of the study of drugs. The book Fighting Disease with Drugs,[1] a publication of the National Conference of Pharmaceutical Research, has been especially helpful in the study of the historical development of drugs and in the evaluation of the problem as a unified whole. Although most of the report presents data from the literature, since most is quite basic to the expert in this field, footnotes have been used rather sparingly.

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[1]John C. Krantz, Jr., ed., Fighting Disease with Drugs, A Symposium by several authors (Baltimore: Williams & Wilkins Company, 1931).

CHAPTER II

HISTORICAL DEVELOPMENT OF DRUGS

The oldest written records of which we have knowledge contain references to certain drugs and the medicines made from them. For example, the Chinese Emperor Shen Nung who lived about 2700 B.C. compiled a book of herbs;[1] the Ebers Papyrus, written more than 4000 years ago, mentions many drugs;[2] and the Edwin Smith Papyrus (about 1500 B.C.) gives us intimations that there was some knowledge of pharmacy then. It is interesting to note, also, that Moses wrote an early prescription as follows: "Moreover, the Lord spake unto Moses, saying, Take thou also unto thee principal spices, of pure myrrh five hundred shekels, of sweet cinnamon half so much. . . and of olive oil an hin: And thou shalt make it in an oil of holy ointment, an ointment compound after the art of the apothecary."[3] These writings of the Chinese, the Hindus, and the Mediterranean peoples even indicate a rather accurate knowledge of the drug sources and effects.

The physician Pien Ch'iao (5th century B.C.) was the first

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[1]Alfred Burger, Medicinal Chemistry (New York: Interscience Publishers, 1951), p. 8.

[2]E.F. Kelly, "The Source of Drugs," Fighting Disease with Drugs, ed. John C. Krantz, Jr. (Baltimore: Williams & Wilkins Company, 1931), p. 41.

[3]Exodus 30:22-25.

Chinese physician as far as the records reveal. He made some drug preparations. Living about seven centuries later was a surgeon, Hua T'o by name, who is thought to have used anesthetics extensively. In India, Susruta, a physician living somewhere near the time of Christ, wrote treatises in which he mentions more than 700 vegetable drugs, many mineral drugs, and a number of animal drugs. Also, translations of the tablets from the library of King Assurbanipal of Assyria (tablets dating back to the Babylonian and Assyrian civilization) have revealed that 250 vegetable drugs and 120 mineral drugs are mentioned. Although there have been several Egyptian medical papyri translated, the most important of these is the Papyrus Ebers; it mentions more than 700 drugs and contains around 800 prescriptions.

In regards to the relationship of these early peoples to later periods, it should be said that the drugs and forms of medications used by the Greeks, and still later the Romans, differed from the drugs and medications of the ancient Egyptians very little.[4]

It cannot be overemphasized, then, that pharmacy is no new thing, but rather extends its roots into the very remote historical past and undoubtedly beyond that. Of course, the drugs of those early periods were often quite different from those used today. The Egyptians, for example, used vinegar as a remedy for pain, moisture from pigs' ears as a spray or gargle, stinking fat to remove blemishes, lizard's blood in the treatment of nausea, and a mixture of the excreta of flies and a plant as a soothing syrup for babies. Fox lungs were prescribed for

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[4]Edward Kremers and George Urdang, History of Pharmacy (2d ed., Philadelphia: J.B. Lippincott Company, 1951), pp. 4-15.

"shortness of breath" since a fox never seemed to tire.[5]

Although the principal aim of the alchemists of the Middle Ages was to find the elixir of life and to change base metals into gold, yet it was they who bridged the gap between ancient and modern pharmacy. Alchemistic study flourished among the Alexandrian philosophers during the 4th and 5th centuries. Later (in the 7th century) the Arabs conquered Egypt and took with them much of the learning of that culture and, in fact, fostered all the sciences including alchemy, thus helping to keep it alive. Toward the close of the Middle Ages alchemy received an impetus due to the contributions of several learned men such as Roger Bacon and Albertus Magnus and to the laboratories that were set up by many princes in France, Italy, and Germany in their palaces.

The first alchemist to use the chemical compounds he discovered to treat the sick was Valentinus, a 15th century Benedictine monk of Northern Germany.[6] After this many of the alchemists used their products predominantly for the alleviation of suffering. Pharmacy, which really means the production of medicinal preparations, actually began, then, during this period. It was at this time, also, that pharmacies featuring vegetable medicinal products were introduced into Europe through Arabic influence. Aqueous extraction of plants was first practiced; later extraction with alcohol was favored. Besides the vegetable drugs, however, the 15th century alchemists used certain oils, mercurial salve, saltpeter, and several antimony preparations

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[5]W. Bruce Philip, "The Corner Drug Store," Fighting Disease with Drugs, ed. Krantz, pp. 197-199.

[6]A.R.L. Dohme, "The Dawn of Pharmacy," Ibid., p. 28.

as medicines.

Paracelsus, a Swiss-German physician living in the 16th century, made an extensive study of drugs and their effects which really led to the dawn of modern pharmaceutical chemistry. He greatly helped to make chemistry a true science by following the phrase he coined, "it is not the task of alchemy to make gold, to make silver, but to prepare medicines."[7] After this there began to be a distinction between alchemists, who sought to transmute metals and to find the philosopher's stone, and chemists, who desired to discover the scientific relationship between chemistry and medicine. There also came about a great change in the pharmacies. Dohme[8] indicates that "Before the time of Paracelsus pharmacies were merely depositories of roots, herbs, syrups and various confections of drugs; and pharmacists were merely mixers of known drugs. Thereafter, they had to qualify for compounding the preparations the physician prescribed, and in consequence had to study chemistry and botany."

From this time onward many men have contributed significantly to the progress of scientific pharmacy. Pioneers of the 16th and 17th centuries such as Van Helmont who first recognized acidity and alkalinity, Angelus Sala and Daniel Sennert who studied extensively the best forms in which to administer medicaments, Franz de le Boc Sylvius who recognized that combustion was the same as respiration, and Tachenius who by his labors contributed much to the study of qualitative and quantitative analysis, all helped to lay a solid pharmaceutical

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[7]Kremers and Urdang, p. 53.

[8]Dohme, p. 33.

foundation upon which modern pharmacy is built. Because the pharmacists of this time were expected to prepare their special medicines and new products, they became able chemists; hence, it is not surprising that some of the greatest chemists started in the pharmacies.

Discoveries during the past 200 years have been almost numberless. Perhaps the most beneficial to medicine was the introduction of nitrous oxide (laughing gas) as an anesthetic by Sir Humphrey Davy at the beginning of the 19th century. Ether was used soon afterward. Also, during the 19th century several alkaloids, which are the vital ingredients of many drugs, were isolated. Some synthetic drugs were made as well. In the 20th century outstanding developments such as the discovery of the antihistamine drugs, the antibacterial sulfonamide drugs, penicillin, and cortisone indicate that the search for better and more effective drugs ever continues. Some discoveries have been the major contribution of one person, others represent the teamwork of many chemists.

The development of pharmacy in our own country is interesting. Not many years ago, for example, tonics, which were concoctions purporting to improve the state of health in general and to cure many different diseases in particular, were widely used by the population. The standard formula for many of these tonics included a laxative drug, a nerve stimulant such as strychnine, small quantities of bitter-tasting materials, and a little alcohol to improve the viewpoint of the person taking it.[9] The claims made undoubtedly far exceeded the

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[9]Austin Smith, The Drugs You Use (New York: Revere Publishing Company, 1948), p. 15.

actual value of the tonic if it had any value at all. With a more enlightened populace, however, much more emphasis is now placed on specific drugs for specific purposes. Stringent requirements have been instituted by law and these help to safeguard the public against misrepresentation.

It is certain, then, that the art of the apothecary (or pharmacist) is one of the oldest in the world. Although there seems to be a distinction made between the apothecary and the physician (the prescribing or the compounding of drugs) in early Egypt, it is not known which preceded the other in development. But it is known that from that early time to the day Leenwenhoek saw microbes under his home-made microscope more than 270 years ago, to the day Jenner performed the first vaccination for smallpox some 170 years ago, to the present century when the miracle drugs have climaxed a series of marvelous achievements, there has been unfolded a drama played by men working together in both the prescribing and the compounding of drugs--men who have fought a winning battle against disease through the use of drugs.

CHAPTER III

SOURCE OF DRUGS

Classification

The classification of drugs may take one of several forms. Very generally speaking it may be said that drugs are of two types. The first type destroys or removes the cause of the disease; the second only ameliorates the symptoms and assists in healing the lesions. A classification based on the fundamental types of pharmacological action will be given later. One useful classification relates to the source of drugs of which it may be said that there are four--vegetable, animal, mineral, and synthetic.

Drugs of Vegetable Origin

A listing of vegetable drugs would be almost limitless because from plants come most of our drugs and it has only been in recent years that animal, mineral, and synthetic sources have become important. The plant takes inorganic substances and forms organic ones from them, that is, the chloroplast is able to take the energy of the sun and synthesize glucose and proteins by breaking up the carbon dioxide and water present in the green cells. Some plants combine the glucose with other organic products formed by the plant and produce glucosides which are used as medicines. For example, the dried leaf of the plant Digitalis purpurea yields the glucosides known as digitoxin, gitalin, and Kiliani's

digitalin. These drugs are used for shock, pneumonia, and as heart and circulatory stimulants for heart disease.[1]

The investigation of plants has revealed that most of them contain some tannin at some time during their development. Tannin has the property of shrinking and wrinkling the skin, hence a drug containing it is called an astringent. The source of tannic acid is the nutgalls of the oaks native to the Mediterranean countries. These nutgalls are tumor-like growths formed on oak leaves and twigs initiated by the action of insects.[2]

Some plants form substances called alkaloids. These organic compounds will combine with acids to form salts like alkalies--hence the name. As far as alleviating suffering is concerned, the alkaloids are the "crowning synthesis" of plant life. There are more than 200 alkaloids known but the best known are probably quinine, strychnine, and morphine. Opium, which is the air-dried milky juice of the poppy, contains several alkaloids. Chief among these is morphine and codeine. Cinchona bark from trees originally from the Peruvian tropics yields the alkaloid quinine. Quinine is used to help relieve the patient of the symptoms of malaria and is used as an antipyretic in fevers. Morphine is used principally as a depressant to alleviate pain.

Ephedra, an alkaloidal drug of Chinese origin, contains the alkalcid ephedrine. This drug is used as a stimulant to the sympathetic nervous system, accelerating the heart and inhibiting and

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[1]Heber W. Youngken, "Drugs from the Vegetable Kingdom," Fighting Disease with Drugs, ed. Krantz, pp. 63-64.

[2]See Ibid., pp. 68-69, for an exceptionally interesting discussion of nutgall formation.

relaxing the intestine.

Another example of an alkalcid is emetine, which comes from the South American alkaloidal drug Ipecac. Emetine will kill the amoebic dysentery parasite. Ipecac itself is used as an emetic.

The enzyme action in plants produces some drugs. That is, their medicinal value is due largely to the activity of the enzymes they contain. This is true of drugs like mustard seed, cherry laurel leaves, and yeast. The mustard plaster, for example, gives a burning sensation because an enzyme in the black mustard seeds splits the glucoside present and produces the strong mustard oil.

Plants containing drug components are now gathered from all over the world from every conceivable source. Most of the supply comes into three or four principal markets from which it is distributed.

Drugs from Animal Sources

Since antiquity it has been known that certain parts of animal bodies also possess medicinal value, although until quite recently almost all drugs came from plants. The ductless glands of slaughtered animals were formerly discarded. In recent years, however, the value of these has been realized and so now all these glands--thyroid, pancreas, pituitary, and the suprarenals--are used in the making of drugs for the treatment of disease. Also, pepsin, which contains a valuable enzyme, has been used in the treatment of digestive disorders. It is obtained from the stomach of hogs. Pernicious anemia is treated by the use of animal liver. Insulin, which is used in the treatment of diabetus, is obtained from the pancreas of sheep, hogs, and cattle.

So, although the modern slaughter-house has come to be one of the

most undesirable places, as well as being the source of most of the nation's meat supply, it is the source of some of our most important drugs as well.

Drugs from Minerals

Here again a listing of drugs obtained from minerals would be almost inexhaustable. "Through pharmaceutical science, the rocks of the earth, the mineral springs, the wastes of the sea, the sands of the desert, and even the gases of the atmosphere are made to yield indispensable drug products."[3]

The so-called founder of Greek medicine, Hippocrates, (born 460 B.C.) used the mineral drugs alum, mercury, sulphur, and lime. Then mineral drugs were chiefly used externally, but in the 16th century, Paracelsus gave impetus to their internal use.

Bromine, which was discovered in 1826, is used extensively in some of its compounds such as potassium or sodium bromide as a sedative. Calcium compounds are used in the correction of calcium deficiencies (known as rickets) and as an ingredient for some ointments for burns and ulcers where they help prevent irritation of tissues. Calcium carbonate is used as a base for some tooth pastes.

Iodine is one of the most common mineral drugs. It was first discovered in 1811. Everyone is familar with its use as an antiseptic. It is also used to prevent certain types of goiter which sometimes appear where there is a deficiency of this mineral.

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[3]William J. Husa, "Drugs from Mineral Sources," Fighting Disease with Drugs, ed. Krantz, p. 84.

Perhaps the student would never think of oxygen as a drug, but it is the most important gaseous drug. Other gaseous drugs include nitrogen dioxide (laughing gas) and ether, both used as anesthetics; and chlorine, the compounds of which are used as dressings for wounds, bleaching agents, disinfectants, and agents for water purification.

There are more than 50 standard pharmaceutical preparations of the mineral iron. The salts of iron are used in the treatment of some types of anemia. Contrary to popular opinion, these salts only stimulate the natural processes by which blood is made; they do not enter the blood to make up the iron deficiency directly.

Copper and silver compounds are also important in medicine. Organic combinations of silver are often used as germicides in infections of the mucous membrane. Copper sulphate is used as an astringent wash.

Synthetic Drugs

Before the 20th century man was dependent on plants, animals, or minerals for his drugs. However, as soon as the active components of vegetable drugs were isolated, attempts at their synthesis began. Now, man is not entirely dependent on the original sources as some drugs occurring in nature have been synthesized, and chemistry has even succeeded in synthesizing many new products which do not occur in nature at all. Society is depending more and more on these. The synthesizing of drugs is accomplished by building up or modifying the molecules of some crude naturally occurring substance by some chemical means.

In the middle of the 19th century the earliest of the synthetic organic chemicals which were used extensively in medicine were

discovered. These were ether and chloroform.[4] Although the juices of certain plants like the poppy were used in ancient times to produce a stupor for crude operations, modern surgical practice is possible only because of some of these synthetic drugs.

There are a number of synthetic organic compounds used for the production of sleep (hypnotics). Chloral was used in the mid-nineteenth century, but it was not safe. A much better hypnotic which has been produced synthetically is barbital. It appeared at the beginning of this century. "Barbital is effective in moderate dosage, and its use today exceeds that of all other hypnotics. Barbital produces a deep restful sleep, with little after-effect upon wakening."[5] Phenobarbital, another synthetic compound, significantly helps the epileptic to overcome the tendency to epileptic seizures.

Cocaine is a natural product that is used as a local anesthetic, but there are serious disadvantages to the use of cocaine, although it is efficient. Fortunately, a series of local anesthetics have been synthesized, among them novocaine which is much less toxic than is cocaine and is not habit-forming. It is widely used.

Coniine was the first alkaloid to be synthesized (1886),[6] but since that time many have been made in the laboratory. Among these are atropine, nicotine, and cocaine.

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[4]J.S. Keyser, Chemistry and Therapeutics of Synthetic Drugs (London: George Newnes, 1950), p. 2.

[5]Ernest H. Volwiler, "Drugs Made by Man: Building New Compounds," Fighting Disease with Drugs, ed. Krantz, p. 149.

[6]Roger Adams and Oliver Kamm, "Drugs Made by Man: The Duplication of Natural Products," Ibid., p. 135.

Space does not permit more than reference to the synthesis of antiseptics such as the Chloramine series all of which are derived from a by-product in the manufacture of saccharin, and merthiolate, an organic mercurial antiseptic; of fat-like compounds like ergosterol, which when exposed to ultra-violet light is partly converted into the drug vitamin D; of germicides such as metaphen, a mercuric compound; of purgatives such as the organic compound phenolphthalein; and a host of others. Special attention will be given to a few common synthetic drugs in Chapter V.

So colds are treated with aspirin; syphilis with salvarsan; cuts and injuries with mercurochrome and hexylresorcinol; headaches with acetanilid; and foods, many of which were formerly sweetened with sugar, are now sweetened with saccharin--substances that nature never knew.[7] Man is ever on the search for new drugs. If he finds it, he tries to duplicate it. If he does not find it, he tries to synthesize a drug suitable for his needs.

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[7]Kelly, p. 53.

CHAPTER IV

THE DRUGS OF TODAY

Classification

Reference has already been made to the classification of drugs. Since our interest in drugs is mainly concerned with their effects on the human body, it has been desirable to now group drugs on that basis. Table I shows a classification based on the types of pharmacological action.

Although to summarize some essential facts about drugs has been one purpose of this study, actually it is an impossible task to adequately bring within a few pages the material essential for a basic understanding. Nevertheless, reference to a few principles, together with illustrative examples, should give the teacher with some chemical background a starting point in his presentation of this important topic.

Since it would be impossible here to treat all the topics as listed in Table I, in this chapter yet another classification has been used. The discussion of drugs has been grouped under four main headings: Drugs used for their effects upon the nervous system, drugs used for their effects upon other body systems, drugs used in prevention and treatment of disease, and drugs used for their local effects.[1]

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[1]Margene O. Faddis and Joseph M. Hayman, Textbook of Pharmacology (4th ed., Philadelphia: J.B. Lippincott Company, 1953), pp. xvi-xxiii.

TABLE I[2]

DRUGS ACTING CHIEFLY TO PRODUCE STIMULATION OR DEPRESSION

	STIMULATION	DEPRESSION
I.	Drugs acting chiefly on the Central Nervous System	
	Caffeine group	Sedatives (Bromides, etc)
	Strychnine group	Hypnotics or Soporifics (Barbitals, etc)
		Narcotics (Opium group)
		Alcohols
		General Anesthetics
II.	Drugs acting chiefly on Special Brain Centers	
	Respiratory stimulants	Antipyretics
	Pyretics	
	Emetics	
III.	Drugs acting chiefly on the Peripheral Nervous System	
	Circulatory stimulants	Local anesthetics
	Respiratory stimulants	Atropine group
	Irritants	Ergotoxine
	Pilocarpine group	
	Epinephrine group	
IV.	Drugs acting chiefly on the Circulatory System	
	Digitalis group	Quinine group
	Barium salts	Nitrites
	Epinephrine group	Caffeine group
V.	Drugs acting chiefly locally on or in the Castro-Intestinal Tract	
	Carminatives	Benzyl compounds
	Cathartics	Nitrites
	Emetics	

DRUGS ACTING CHIEFLY THROUGH REPLACEMENT OF DEFICIENT BIOLOGIC FUNCTIONS

I. Glandular products and tissue extracts
Insulin, thyroxin, epinephrine, pepsin, etc.

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[2] Harold N. Wright and Mildred Montag, A Textbook of Pharmacology and Therapeutics (Philadelphia: W.B. Saunders Company, 1948), pp. 107-110.

Table I, Continued

II. Serums, vaccines, and antitoxins
Smallpox vaccine, diphtheria antitoxin, etc.

III. Vitamin Preparations
Fish liver oils, vitamin concentrates, viosterol, etc.

IV. Medicinal Foods
Dextrose, glucose, lactose, etc.

V. Allergenic Preparations
Protein extracts

DRUGS ACTING CHIEFLY THROUGH SALT OR OSMOTIC EFFECTS

HYPERTONIC SOLUTIONS	ISOTONIC SOLUTIONS
Saline cathartics	Injections of drugs
Local application	Infusions of saline or glucose
Astringents	Solutions for application to mucous membranes

DRUGS ACTING CHIEFLY THROUGH AN IRRITANT OR DEMULCENT ACTION

IRRITANT	DEMULCENT
Irritant gases	Fats, oils, soaps, etc.
Acids and Alkalis	Mucilages, etc.
Irritant volatile oils	Proteins, etc.
Most coal tar antiseptics	
Heavy metal antiseptics	
Oxidizing antiseptics	

DRUGS ACTING CHIEFLY ON PARASITIC INVADERS OF THE BODY

I. Chemotherapy of Bacterial and Virus Infections
Streptococcic, pneumococcic, meningococcic, infections

II. Chemotherapy of Spirochetal Infections
Syphilis, relapsing fever, rat bite fever, etc.

III. Chemotherapy of Protozoal Infections
Malaria, amebiasis, African sleeping sickness, etc.

IV. Chemotherapy of Metazoal Infections
Hookworm, tapeworm, roundworm, pinworm, etc.

Drugs used for their Effects upon the Nervous System

The Strychnine group and the Caffeine group are the important group of drugs which produce stimulation of the central nervous system. The Strychnine group stimulates chiefly the spinal chord and the medullary centers; whereas the Caffeine group produces stimulation of the cerebrum, although all parts of the central nervous system are stimulated to some extent. An overdose of strychnine may produce convulsions; an overdose of caffeine usually only mental excitement and insomnia, but the active principles of both are the same alkaloids. Strychnine is derived from the seeds of a small tree grown in the East Indies and Ceylon while caffeine occurs in the coffee, tea, and cola plants.

There are a great number of drugs which produce not stimulation but depression of the central nervous system. These include such well-known groups of drugs as the narcotics, sedatives, hypnotics, soporifics, and the alcohols.

The narcotics, of course, include opium and marijuana but also synthetic compounds such as Demerol and Methadon. The opium group of narcotics are among the most powerful in the production of the depression of the central nervous system. They are also the most important clinically. Opium, whose principal alkaloid is morphine, produces two actions: (1) it tends to induce sleep and (2) it relieves pain. Opium has been used for many centuries; Galen, a physician of the 2nd century A.D., spoke highly of it. It contains more than 20 alkaloids.

The effects produced by morphine will illustrate the effects of the narcotics in general. Administration of morphine tends to diminish the attention paid to the sensory stimuli thereby alleviating pain, and attending action of the drug lessens ability to think or remember;

with increased doses an apathetic, dreamy condition is experienced and finally sleep. Before sleep there may be highly pleasant hallucinations (euphoria). There is a slowing of the rate of respiration and an interference with intestinal contractions producing constipation. The chief uses of morphine and opium include, besides the relief of pain, preanesthetic medication to allay fear, checking of diarrhea, and breaking up of incipient colds. Codeine, which is found in opium, has about the same properties as morphine but is less strong, while heroin is from 4 to 8 times as potent as morphine and there is much greater danger of addiction with its use. Its importation and manufacture have been prohibited in the United States by the Harrison Narcotic Act. Demerol and Methadon possess many of the properties of morphine. Both produce less depression of the brain than morphine, Demerol the least of all three.

The dried flowering tops of the hemp plant, Cannabis Sativa, which grows wild in many parts of North America, is the source of marijuana, another depressant. The drug produces euphoria and although there is no addiction in the same sense as to morphine, there is a strong desire to return to the drug whenever the person wishes to escape undesirable circumstances. At first there is strong excitation with emotional instability and sometimes intense fear. There is often a desire for excessive motor activity and a feeling of floating on air. The inhibitions of society are suppressed and many crimes are committed under its influence. Later there is a period of calm and contentment and finally sleep.

Drugs possessing little if any ability to relieve pain but which have the property of inducing sleep are called sedatives, hypnotics, or

soporifics. Sometimes these drugs are combined with pain-relieving drugs (analgesic) such as acetyl salicylic acid and then used as a substitute for morphine in cases of less severe pain. Barbiturates are hypnotic derivatives of barbituric acid, a synthetic organic derivative itself. The barbiturates, of which about twenty have been found useful, depress the cerebral cortex and the subcortical ganglia and hence produce sleep promptly. They are especially effective in conditions of mental or motor hyperirritability, that is, worry, convulsions, etc., and may be used to induce sleep or just to quiet the patient. Barbital and phenobarbital both produce these effects, but phenobarbital is much the stronger. Other depressant drugs include the bromides, which are white crystalline substances that depress the activity of the brain and lessen muscular twitchings, creating a tendency to sleep; chloral hydrate, also a white crystalline substance which depresses the entire central nervous system; and paraldehyde, a polymer of acetaldehyde. The latter is fast in that it produces sleep in 10 or 15 minutes. These drugs are used to prevent convulsions as well as for many other conditions.

Although it is certain that in large doses alcohol is depressant to the central nervous system, there has been some disagreement over the effects of small doses. The best opinion seems to be that the apparent stimulation is really a depression of the cerebrum, the depression of which results in a loss of inhibitions and hence the appearance of stimulation. It is true, however, that with small doses there is a true stimulation of circulation and respiration. Therefore, alcohol can be used as a stimulant to the heart and respiration for shock and for acute infectious diseases such as influenza and pneumonia, in which

the heart is most likely to fail.

The anesthetics, of which ether, chloroform, and nitrous oxide are probably the best known, also are depressants of the central nervous system. One group of drugs are used for general anesthesia in which a state of complete unconsciousness is produced, and another for local anesthesia in which the anesthesia is confined to a certain portion of the body, consciousness being maintained. Ether when mixed with oxygen is explosive, whereas chloroform is not; however, chloroform is more dangerous because it produces a progressive fall in blood pressure. Nitrous oxide alone does not produce sufficient relaxation of the abdominal muscles for abdominal operations. Ethylene is an explosive gas, but its after-effects as an anesthesia are very slight and it is probably the safest of all anesthetics used today. Barbituric acid derivatives also produce a state of general anesthesia when injected intravenously, but they are used for short operations only. Local anesthetics include cocaine, the most important, and phenylcarbinol. These are injected into the area to be anesthetized and they paralyze the peripheral sensory nerves.

Drugs used for their Effects upon other Body Systems

A respiratory center in the medulla controls respiration and in cases of threatened paralysis of respiration, respiratory stimulants are needed to increase the rate and depth of respiration. In some kinds of poisoning death occurs because of failure of respiration. The respiratory drugs may stimulate the respiratory center sufficiently to save the patient. Among the drugs used for this purpose is carbon dioxide, the normal hormonal regulator of respiration; picrotoxin,

obtained from fishberries; and metrozol. Both of the last named drugs cause a reversal of the depression of the cortical brain centers and also directly stimulate the respiratory center. Artificial respiration is necessary in cases of extreme arrested respiration.

Heart disease in one form or another is the largest one cause of death in the United States today and in this area there are many drugs used for various physiological conditions. Digitalis, a drug obtained from the leaves of purple foxglove, is one of the most important. The active principles are called glycosides. Digitalis increases the irritability and force of contractions of the heart; the heart is brought nearer to normal size, and the heart rate is decreased. Because of these actions the circulation of the blood is improved and shortness of breath disappears. Strophanthus, from an African climbing plant, is also used as a heart stimulant. Other drugs, such as quinine and quinidine are used as cardiac depressants. Both are obtained from cinchona bark. They are used in treatment of fast irregular beating of the heart. Still other drugs act mainly on the blood vessels. One of these, epinephrine, is an aquecus extract from the adrenal glands of domestic animals. It increases the heart rate by stimulating the nerve endings of the sympathetic or accelerator nerve to the heart and it increases the blood pressure by constricting the capillary blood vessels. It is used for shock and collapse. Ephedrine and pituitary preparations produce somewhat similar effects.

Drugs called hemostatics or styptics are used to arrest hemorrhage. Surface application of drugs like epinephrine or neosynephrine may cause enough vasoconstriction to stop the hemorrhage, but the most effective way is to coagulate the blood proteins so that a clot is formed. This

can be done by using strong precipitants of protein like burnt alum or copper sulfate.

Many drugs are given specifically to affect the gastrointestinal tract. Among these are the bitters, the emetics, and the cathartics. Bitters are drugs used to increase the appetite and digestion and to modify the taste of medicine. Gentian is a representative drug. Emetics are drugs which produce vomiting, but when possible the lavage tube is used for the evacuation of the stomach because of the ill effects sometimes accompanying emetics. Ipecac, obtained from the root of a plant and containing several alkaloids, is an example.

If there is heart-burn or hyperacidity in the stomach, alkalis like sodium bicarbonate are used. It may also relieve excessive urinary acidity. If a treatment for gastric ulcer is needed, gastric mucin, derived from hog stomachs, may be used. If a stimulation of gastric secretion is desired, histamine, a derivative of the amino acid histidine, may be used. It is the most effective drug for this purpose.

A more generally used type of drug is the cathartics. They are substances which induce defacation. There are really three types: (1) laxatives, which produce more frequent stools of nearly normal consistency, (2) purgatives, which cause more frequent semifluid stools, and (3) drastics, which cause watery stools (with irritation). Cathartic drugs will, as a rule, either produce an increase in the bulk or produce an irritation on the mucous membrane. Agar, which is obtained from seaweeds; liquid petrolatum, a mixture of liquid hydrocarbons; and olive oil, obtained from the ripe fruit of the olive tree, all work by adding to the bulk of the intestinal contents and

by softening them. On the other hand, rhubarb, senna, and cascara, all three the active constituents of certain plants, are oxidized or hydrolyzed in the intestines. This gives rise to new chemical substances which produce the action. Phenolphthalein is a synthetic compound that is useful as an irritating cathartic. Castor oil is saponified in the intestines and forms irritant ricinoleates which produce increased activity of the small intestine and the rapid passage of the intestinal contents cause the stools to become more fluid.

A number of drugs are used to affect the uterus or the urinary tract, but only two will be mentioned. The alkaloids of Ergot, a fungus which grows on rye and other grains, are used to increase the tone and rhythmic contractions of the uterus. Various hormones also affect the uterus. The principle diuretics (drugs used to increase the flow of the urine) belong to the Xanthine group, which occur in several plants. Caffeine is the most important.

Drugs used in Prevention and Treatment of Disease

Out of the almost numberless drugs used in the treatment of specific diseases, reference can be made to only a few.

1. Drugs used to lower the body temperature: These drugs are called antipyretics and they include quinine, which acts both as an antipyretic and analgesic (pain-reliever); opium, morphine, and codeine, which besides relieving pain have an antipyretic effect; and acetanilid, a synthetic derivative of the coal tar products Phenol and Aniline.

2. Drugs used in the treatment of syphilis: Penicillin is the most important among the antisyphilitic drugs. Its action is probably

directly on the spirochetes. Mercury or bismuth and their compounds are also injected for its treatment. The discovery of salvarsan in 1910 was the first of a series of important compounds of arsenic which are now used in antisyphilitic therapy. The organic compounds of arsenic which are used most today (in place of salvarsan) are neoarsphenamine and sulfarsphenamine.

3. Drugs used in the treatment of malaria: Malaria affects millions of people annually and is probably the most widespread disease in the world. It is caused by a protozoan parasite. There are two types of drugs used--those which attack the parasites in the blood and therefore used for acute attacks, and those which attack the tissue forms of the parasite in the liver. The latter are used to cure persons with malaria. Quinine, atabrine, and chloroquine phosphate are effective drugs against the blood forms. Atabrine is a synthetic substitute for quinine. They both affect the asexual forms of the parasites and therefore check the disease. Primaquine, a drug introduced since the Korean War, destroys the tissue phase of the parasite.

4. Drugs used in the treatment of amebiasis: The gastrointestinal tract may be the habitation of a number of amebae. The most important is the organism of amebic dysentery. Organic arsenicals such as Acetarsone and iodine compounds such as Chiniofon are used in the treatment of amebiasis.

5. Drugs used in the treatment of bacterial infections: Emphasis in this area centers around the sulfonamides and the antibiotics, a discussion of which follows in the next chapter.

6. Drugs used in the treatment of leprosy: A new compound, Sulfoxone Sodium, is now being used for leprosy in place of the old

remedy, chaulmoogra oil. With the use of Sulfoxone Sodium lesions fail to progress and then gradually improve. As a rule, the nodules decrease and finally disappear altogether.

7. Drugs used in the treatment of rheumatic fever: Sodium salicylate relieves the pain and other symptoms of rheumatic fever so successfully that, if it fails, faulty diagnosis is suspected. The antipyretic and analgesic properties of the drug may account for the improvement or the drug may attack the causative organism; however, the drug probably has no direct effect on the cause of the disease. It is given orally.

8. Drugs used in the treatment of epilepsy: The bromides and phenobarbital are still sometimes used in combination with some of the newer drugs in the treatment of epilepsy. Dilantin, a complex synthetic compound with an anticonvulsant action, is now recommended for patients who do not respond to bromide or phenobarbital treatment. Phethenylate sodium and Trimethadione are other synthetic anticonvulsant drugs used to treat epilepsy. Each is more effective with one type of epilepsy than with other types.

9. Drugs used in the treatment of arthritis: Gold compounds are a recognized treatment for active rheumatoid arthritis. The gold salts are injected intramuscularly or intravenously. Cortisone and ACTH are also used today.

10. Drugs used as immunologic agents: Among other things these agents will contain (a) living organisms to be taken orally, (b) serums such as antitoxin (sterile aqueous solutions of antitoxic substances producing passive immunity), (c) toxins (toxic products of a bacterial cell; used as antigens to produce active immunity), (d) vaccines, which

may contain living organisms as small pox vaccine, killed organisms as in bacterial vaccines, or sensitized killed organisms as in Serobacterins, (e) tuberculins (sterile solution of the products of growth or an extract of the tubercle bacillus), or (f) protein antigens. An antigen is a substance which causes the formation of specific antibodies by the body tissues.[3] The formation of diphtheria antitoxin illustrates how one of the agents is made. First, a horse or other animal is injected with several doses of diphtheria toxin over a period of from three to six months. Its body produces antitoxin. After the proper time has elapsed, the horse is bled and the blood is collected in vessels containing sodium citrate solution and it is allowed to settle. The clear serum is siphoned off and the antitoxin bearing globulins are separated from the rest of the constituents.

Among the antitoxins, besides diphtheria, are the gangrene, the tetanus, and the scarlet fever streptococcus antitoxins. Among the toxoids (a toxin having its toxic properties neutralized or destroyed) are the diphtheria and the tetanus toxoids. The vaccines include smallpox, rabies, typhoid, typhus, yellow fever, and plague. Vesicles of cowpox, obtained from healthy vaccinated animals of the bovine family, are used to make the smallpox vaccine, while the virus of yellow fever is cultured in the embryo of a domestic fowl to prepare yellow fever vaccine. The most recent of these vaccines, of course, is the polio vaccine discovered by Salk and used for the first time on a mass scale in the spring of 1954.

11. Drugs used for treatment of the endocrine system: Reference

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[3]Heber W. Youngken, Textbook of Pharmacognosy (Philadelphia: The Blakiston Company, 1950), pp. 981-982.

will also be made to these drugs in the following chapter.

Drugs used for their Local Effects

Chief among the drugs used specifically for their local effects are the antiseptics and germicides or disinfectants. There is a distinction drawn between these terms; an antiseptic prevents the progress of an infection principally by preventing the multiplication of bacteria while a germicide kills all the bacteria. Disinfectant should be used synonymously with germicide.[4] Many of the antiseptic drugs are also astringent in their action, that is, they reduce inflammation by drawing the water out of swollen tissues.

The effects which these drugs produce is due to their effects on proteins. Many antiseptics are able to precipitate the proteins of the bacteria, while astringents are able only to produce a condition under which the bacteria are unable to multiply, hence giving the body an opportunity to build up its natural defenses. Because the bacterial proteins are more easily precipitated than the tissues, it is possible to make antiseptics which do not harm the host, yet which kill some of the bacteria and inhibit the action and the multiplication of the rest. It is likely that some antiseptics also produce other effects, such as interfering with the cellular metabolism of the bacteria.

The chief antiseptics might be divided into the coal tar group, including phenol (carbolic acid), cresol, and resorcinol, all of which precipitate the proteins of the bacteria and have some astringent action; the dye group, including methylene blue; the halogen group,

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[4]Wright and Montag, p. 492.

including chlorine, which is used to disinfect drinking water, and iodine; the mercury group; the silver group, including silver nitrate which is used in the treatment of infections of the mucous membranes and as a prophylactic measure is placed in the eyes of new-born infants; and the alcohols. Boric acid, tannic acid, and alum are three drugs which are used specifically for their astringent action.

Besides the antiseptics there are a host of drugs used on the skin for other purposes. Bland, oily substances, known as emollients, are used to relieve irritation and to make the skin softer. Theobroma oil and cottonseed oil are examples. Powders, lotions, liniments, and ointments are often soothing and astringent to the skin, and depending on their ingredients, may have antiseptic value. Powders take up small quantities of moisture. A common lotion is Calamine lotion; a common liniment (a lotion with an oil or soap in it) is Calamine liniment. Thymol iodide, a mixture of iodine derivatives of thymol, is a useful powder.

There are also a number of drugs to be applied to the skin and designed for the control of certain specific conditions such as the antifungal agents and drugs used in the eye. Since little can be said about them as a group, however, no further reference will be made to them.

CHAPTER V

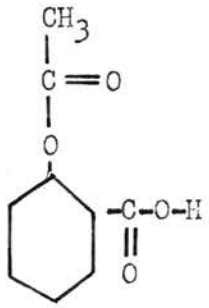
SPECIAL TOPICS FOR EMPHASIS

Aspirin, A Common Drug

Since the foregoing material necessarily has had to be so general, it might be well to take one of the most common drugs of today and investigate its discovery, structure, use, and effects. Aspirin has been selected although any number of others could have been chosen.

Acetylsalicylic acid (or aspirin) is a synthetic derivative of the coal tar products phenol and aniline. It was discovered by Dreser in 1899 in the process of attempting to find a cheap method of obtaining quinine.

Aspirin has the following formula which is given to indicate the complexity of these drugs.



Or written in another way: o-$CH_3COOC_6H_4COOH$, the o meaning that the $OOCCH_3$ and COOH groups are adjacent on the benzene ring. Its preparation from salicylic acid and acetic anhydride is as follows:

$$o\text{-}HOC_6H_4COOH + (CH_3CO)_2O \longrightarrow o\text{-}CH_3COOC_6H_4COOH + CH_3CO_2H.$$

Aspirin has probably been the most successful synthetic drug made.[1] It is used as an antineuralgic and an analgesic (pain-reliever) for lesser types of pain and also as a sedative (dulls perceptions of and reactions to external stimuli) and as an antipyretic (produces a decrease in fever). The aspirin does not produce gastric disturbances because it passes through the stomach almost unchanged, so it can be used widely in treatment of colds, influenza, and headache. There is no evidence that it is harmful to the heart. In a recent study it was found that aspirin rates better than the antibiotics as a medicine for influenza and flu-like colds.[2] It was reported in 1951 that there was some one million pounds of aspirin produced each month.[3]

New Drugs

Many books have been written on the newly developed drugs alone, and because of their important uses today special reference should be made to them.

1. Penicillin and other antibiotics: Up until 1935 quinine remained the only known drug for the treatment of infections.[4] In 1935 the sulfa drugs were introduced. Although penicillin was discovered by Fleming in 1928 and its antibacterial properties have been known since

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[1]Burger, p. 200.

[2]"Aspirin Beats Antibiotics in Treating Colds, Flu," Science News Letter (Oct 10, 1953), 64:231.

[3]"How 'Miracle' Drugs Turn Out," U.S. News and World Report (Apr 13, 1951), 30:19.

[4]Elizabeth G. Hayward, Penicillin and Other Antibiotics (New York: Scudder, Stevens and Clark, 1949), p. 1.

1929, it was not until about 1942 that its therapeutic value was established. Since then many other antibiotics, a term now used for chemical substances which kill or suppress microorganisms and which are produced by molds, have been discovered. Among these are streptomycin, discovered by Wakesman, aureomycin, and neomycin, discovered in 1949.

The formation of the hard protective coating found around bacterial cells is stopped by penicillin. It is probable that the penicillin interfers with the enzyme action necessary to convert materials into this cell wall.[5]

The antibiotics have been able to stop dozens of infections quickly and permanently; however, their use is limited. For example, penicillin and the sulfas may cause rashes or "drug fever." Aureomycin and terramycin sometimes cause diarrhea and nausea.[6] Also, with their use a resistance may be built up causing a diminution of their power to kill germs. This is perhaps their most serious limitation. But even though penicillin is of no use in such infections as rheumatic fever, leukemia, diphtheria, smallpox and mumps,[7] it is effective against pneumococcal, streptococcal, clostridial, gonococcal, and meningococcal infections. It is also useful in the treatment of syphilis. Streptomycin is the first drug to be used effectively against tuberculosis; neomycin is used in the treatment of intestinal infections.

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[5]"New Wonder Drugs Near," Science News Letter (Feb 2, 1956), 71:71.

[6]"New Light on the Wonder Drugs," Changing Times (Dec, 1953), 7:35-36.

[7]Samuel Epstein and Beryl Williams, Miracles from Microbes (New Brunswick: Rutgers University Press, 1946), p. 120.

It has been estimated that Waksman, the discoverer of streptomycin, and his assistants have isolated about 10,000 organisms and tested each for its action on bacteria.[8] This indicates the amount of work which has been done in this area of study. There are approximately 60 antibiotics now used in the treatment of disease.[9] In all, some 4000 have been discovered.

2. The Sulfa drugs: Of a great many sulfa compounds (about 5000) which have been prepared, only a few are used in medicine. The simplest is sulfanilamide, but its use has largely been replaced by others such as sulfadiazine. It is not known just how the sulfa drugs work, but it is likely that they interfer with the enzymes which are essential to the bacterial growth and multiplication. The sulfonamides have been successful against such bacterial infections due to the hemolytic streptococcus, pneumococcus, gonococcus, and meningococcus.[10] They are useless in the treatment of undulant fever, tuberculosis, colds, measles, and influenza.

3. Hormones: Discovered in 1922 and so not really new, yet insulin is perhaps the most important of the hormone drugs. A solution of the active principle from the pancreas of sheep, hogs, or cattle, it is used in humans when the pancreas is diseased and the normal output of insulin is decreased. It helps restore the blood sugar to normal levels, and the lives of many diabetics are prolonged many

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[8]Cedric Larson, "Selman A. Waksman: Genius of the Antibiotics," Science Digest (Nov, 1956), 40:87-91.

[9]Ibid.

[10]Faddis and Hayman, p. 330.

years by its continued use.

Cortisone, a more recent drug, was originally prepared from the adrenal glands of cattle and hogs. Now the synthesis starts with the bile of cattle and sheep. ACTH is another hormone drug derived from the anterior pituitary of some domesticated animals. These and other hormones are now used in the treatment of many diseases from burns and mental ailments to some disorders of old age. Both cortisone and ACTH are a "doctor's dream" as a cure for rheumatic fever.[11] In 1954 it was reported that a super hydrocortisone, 100 times more powerful than cortisone, had been discovered.[12]

A listing of even newer drugs would take many pages. This short account of some of the more recent drugs, however, should be enough to emphasize the fact that research is continuing toward the discovery or synthesis of new and better ones.

Problem of Misuse of Drugs

The problem of addiction to such drugs as opium is a very old one. With the introduction of other addicting drugs such as morphine, codeine, heroin, and other like compounds and synthetic drugs like Demarol and Methadone, in some respects the problem is even worse.

The drugs just named will, with continued use, cause addiction in which the body cells themselves undergo a change and physical and mental pain will be caused by withdrawal of the drug. Drugs like

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[11]"How 'Miracle' Drugs Turn Out," U.S. News and World Report (Apr 13, 1951), 30:19.

[12]"All about Drugs," Science Digest (Nov, 1954), 36:49-50.

cocaine, marijuana, and the barbiturates, which cause a depression of the central nervous system are called habituating drugs because, in contrast to the addicting drugs, they only maintain a hold on a person like tobacco or alcohol, though often with much worse consequences.[13] The use of the latter type, however, often leads to the use of the former.

One to 5 grains of morphine would be fatal to a normal person, but the body of an addict may build up such a resistance that he will use from 6 to 100 grains per day. The results, of course, are disastrous. Philip[14] writes that

> This drug is expensive, and the desire for it is unrelenting; so a large number of robberies and hold-ups are committed by addicts in order to procure money to obtain the next day's supply of the drug. Drug addiction from the standpoint of pathology may be classified as a preventable disease of an incurable type, marching with rapid strides to the complete moral, mental and physical ruin of its victum.

The general deterioration of the individual as the drug is constantly used cannot be emphasized too strongly.

In 1956 a Senate Judiciary Committee revealed that the United States now has more than 60,000 drug addicts, more addicts than all other Western Nations combined. It also stated that about 25% of all the crime in the nation is attributable to drug addiction and that illegal dope traffic has trebled since World War II.[15]

There is danger also to the habituating drugs. A craze of recent

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[13] "Facts on Drug Addiction," Science Digest (Sept, 1954), 36:36.

[14] Philip, p. 206.

[15] "The Problem of Dope," Time (Jan 16, 1956), 67:18. Much larger estimates of the number of addicts have been made. See "Narcotic Dilemma," Time (Oct 3, 1955), 66:63.

years, for example, has been for teenagers to take an over-dose of barbiturates (sleeping pills) to get a "high" feeling. Later they take stimulant drugs to overcome the depressing effects of the sleeping pills.[16] There is yet another danger in over-dosage. It has been estimated that one out of every 2000 hospital admissions is for accidental or intentional poisoning by sleeping pills.[17]

More recently great interest in tranquilizers has been shown by the public. These are drugs which are supposed to relieve anxiety without the loss of alertness. In 1955 it was reported that three out of the ten compounds most frequently prescribed were tranquilizers.[18] Although these drugs have been effective in making mental patients more susceptible to treatment, the American Psychiatric Association has vigorously warned against their use in relieving every day tensions.[19] They do have great promise in mental disease treatment.[20]

The control of drugs, especially the addicting ones, is always a major problem. With addiction the goals are to dry up the sources of supply and to eliminate the cause for the drug's use,[21] but there has

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[16] "Food and Drug Rackets--How Bad? How Fought?" U.S. News and World Report (Apr 24, 1953), 34:61-62.

[17] "Built-in Safety in Sleeping Pills," Science Digest (July, 1953), 34:50.

[18] "Peace Pills," Science (July 27, 1956), 124:167.

[19] "Misuse of Tranquilizers," Science News Letter (July 14, 1956), 70:19.

[20] "Relaxing Drugs will Cause Great Change," Science News Letter (Nov 3, 1956), 70:283.

[21] New York Academy of Medicine Conferences on Drug Addiction (New York: The Blakiston Company, 1953). Book Reviewed: Albert Deutsch, "Drug Addiction Among Adolescents," Saturday Review (Sept 19, 1953), 36:20.

been considerable disagreement as to how this should be done. Some advocate more stringent punishment, even death, to the seller of dope. Others believe that the government should give these drugs to the addicts in order to eliminate the profit motives which play a dominant role in the continued promiscuous distribution of dope.[22] The English system of control, in which the physician plays a major role, seems to have worked better than our own in which a punitive program has been predominant.[23] It merits careful study by our authorities.

Number of Drugs

An idea of the number of drugs may be attained from The Dispensatory of the United States of America, which in its 2,139 pages, lists the approved drugs in the United States, British, and International Pharmacopoeias. Eighty pages of index are required just to list the items. About 500 outmoded drugs were dropped from the previous edition; about 500 new ones were added.

There are great numbers of various drug preparations on the market as well. Green,[24] for example, reports that in 1956 a person could select from 57 pain relievers for headache, 144 cough and cold remedies, and 253 different laxatives. The quantity of some of the more popular drugs that are manufactured is also stupendous. In 1944 there was

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[22]"Narcotic Dilemma," 66:64.

[23]"Traffic in Dope," The Nation (Apr 21, 1956), 182:337-339.

[24]Blanche Green, "Drugs on the Market," Senior Scholastic (May 17, 1956), 68:14-15. Green also indicates that 90% of the over one million prescriptions written each day in the United States could not have been filled ten years ago.

produced 750,000 pounds of aspirin and 650,000 pounds of sulfonamides in one month.[25] Actually, a person needs only to step into a large modern drug store to see the almost unbelievable variety of drugs which are available to the public.

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[25]Smith, pp. 4-5.

CHAPTER VI

CONCLUSIONS

The study of drugs is a science in itself. Only special, intensive training will yield a relatively full understanding of their origins, their structures, their uses, and their effects upon the human body. This understanding is left to the specialists in pharmacology, without which modern society would not exist as it is.

However, since drugs have become such a vital part of American life; since, as has been stated in this report, they are administered to produce certain unnatural effects; and since some are attended with grave danger; it seems evident that every citizen should have some practical knowledge about them. Because this knowledge will not be attained at home, it is left up to the school and to the teacher of chemistry or of health or of some other subject to supply it. The high school teacher, though not an expert in this field, can do much to direct his students toward gaining some understanding of the origins of drugs, their uses and dangers. To this end this study has been presented.

GLOSSARY

ACTH: A hormone used to relieve temporarily the symptoms of rheumatoid arthritis and of leukemia. Its chemical composition is unknown.

Alkaloids: Complex drugs which contain nitrogen and act as bases.

Amebiasis: A disease in which certain types of amebae inhabit the human organism causing unfavorable reactions.

Analgesic: A pain-relieving drug.

Anesthesia: A drug producing entire or partial loss of sensation.

Antibiotics: Agents which are produced or derived from living cells of molds, bacteria or other plants, and which destroy or inhibit the growth of microbes.

Antigens: Substances, which when injected into the body, produce antibodies against a disease.

Antipyretic: A drug producing a decrease in fever.

Antiseptic: A substance which retards or prevents the growth of bacteria.

Antitoxin: A substance which is developed in the body and which is antagonistic to some poison.

Astringent: A drug which causes contraction and hence checks discharge of body fluids.

Atabrine: A synthetic yellow powder used in the treatment of malaria.

Barbiturates: Derivatives of barbituric acid which are used principally as cerebral sedatives or anesthetics.

Cathartic: A substance which produces evacuation of the bowels.

Chloroform: A readily vaporizable liquid sometimes used as an anesthetic.

Cortisone: A hormone drug which produces spectacular temporary relief in rheumatoid arthritis and rheumatic fever.

Demerol: A synthetic drug possessing many of the properties of morphine, but chemically quite different.

Depressant: A drug producing a slowing-down of certain body processes.

Digitalis: A drug from the leaves of purple foxglove. It is used as a stimulant for heart diseases.

Diuretic: A drug which increases the flow of urine.

Emetic: A drug which induces vomiting.

Epinephrine: The active principle of the medulla of the suprarenal gland. It is used to stimulate the sympathetic nervous system.

Ergosterol: A substance, the irradiation (with ultraviolet light) of which produces vitamin D.

Glucosides: Organic substances which contain a sugar combined with some non-sugar chemical grouping.

Herylresorcinol: A synthetic derivative of resorcinol, a colorless crystalline solid.

Histamine: A substance occurring in most organs and fluids of the body. It is similar to hormones but its action is primarily connected with the blood vessels.

Hormones: Substances normally secreted by the endocrine or ductless glands for the regulation of body processes.

Hypnotic: A drug used for the purpose of inducing sleep.

Methadon: A synthetic organic compound used to relieve pain.

Narcotic: A drug which will produce marked diminution of mental activity, relieve distress, and induce sleep.

Neosynephrine: A drug used for nasal congestions and for the prevention of hypotension in spinal anesthesia and shock.

Phenobarbital: One of the most potent of the barbituric acid derivatives. It is a drug which produces an hypnotic effect.

Phenolphthalein: A synthetic compound which is used as a cathartic.

Purgative: A medication effecting quick and thorough evacuation of the bowels.

Pyretic: A substance that produces an artificial fever.

Saponify: The decomposition of a fat by an alkali or the hydrolysis of a fat by any means.

Sedative: A drug producing a mild form of depression in which the patient is calmed but awake.

Serum: A fluid which upon injection produces only passive immunity to a disease. (Lasts for only a few days or weeks).

Soporific: A drug which can induce sleep but has little if any ability to relieve pain.

Spirochetes: Any of several slender, spiral microorganisms, many of which cause diseases, as syphilis and relapsing fever.

Stimulant: A drug producing an acceleration of certain body processes.

Strychnine: An alkaloid of the dried, ripe seeds of the small tree Strychnos Nux Vomica.

Synthetic: Artificial.

Tannins: A group of vegetable compounds which will precipitate proteins and hence have astringent properties.

Toxin: A poison formed as a specific secretion product in the metabolism of an organism.

Toxoid: A toxin treated so that its toxicity has been destroyed but which is still capable of causing the formation of antibodies.

Tranquilizer: A drug which soothes and calms but which supposedly does not destroy the alertness of the mind.

Ulcer: An open sore or lesion.

Vaccines: Drug preparations of dead or attenuated bacteria or viruses or of bacterial toxins or toxoids. They produce active immunity.

Vasoconstrictor: A drug causing constriction of the blood vessels.

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