

MEDICAL BOTANY

PLANTS
AFFECTING
MAN'S
HEALTH

WALTER H. LEWIS

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WALTER H. LEWIS

Professor of Biology, Washington University
Senior Botanist, Missouri Botanical Garden

MEMORY P. F. ELVIN-LEWIS

Associate Professor
and Chairman of Dental Microbiology
Washington University
St. Louis, Missouri

A WILEY-INTERSCIENCE PUBLICATION

JOHN WILEY & Sons, New York • London • Sydney • Toronto

Caution

This book is not intended for prescribing medication or for curing afflictions. Its purpose is not to replace the services of a physician but rather to serve as a reference for matters relating to health. We emphasize that the use of any of this information for purposes of self-treatment without consulting a physician can be dangerous.

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Library of Congress Cataloging in Publication Data:

Lewis, Walter Hepworth.
Medical botany.

"A Wiley-Interscience publication."

Bibliography: p.

Includes index.

1. Botany, Medical. 2. Materia medica, Vegetable.

I. Elvin-Lewis, Memory P. F., 1933- joint author.

II. Title. [DNLM: 1. Plants, Medicinal. QV766 L677m]

RS164.L475 615'.32 76-44376

ISBN 0-471-53320-3

Printed in the United States of America

10 9 8 7 6 5 4 3 2

Preface

Medical Botany is designed to bring into perspective the massive knowledge acquired by man to retain his health by using the plants around him. Man's survival has been dependent on his innate curiosity, his desire to examine by trial and error all aspects of his environment, and to conclude, for example, which materials are remedial, which ones are harmful, and which give him the greatest nourishment. This legacy exists today, but it is only partially utilized in our endless quest for well-being.

During the past century, the extraordinary results of research have unquestionably led to the success at an exponential rate that the practitioner of cosmopolitan (modern) medicine now enjoys. However, the nearly exclusive use of this research-oriented approach, with little regard for data acquired through the empirical method, has served to delay the application of many potential benefits. For example, it is unfortunate that man's first cosmopolitan tranquilizer derived from *Rauvolfia* did not come into general use until 1952, despite the long history of its use in Ayurvedic medicine in India, or that cromolyn, the miraculous prophylactic drug for asthma, has only recently been introduced, though its use in the form of *Ammi* seeds was part of Bedouin folk medicine for centuries. The rarity of these discoveries is understandable, however, for it is not always easy to retrieve such information from the many meaningless folk remedies. Whereas a few centuries ago the physician was also trained in botany,

few medical scientists nowadays have this appreciation. Thus their search for medically useful elements seldom combines the ability to distinguish chemical compounds for medical value with the ability to recognize the relationship of plants used medically by different cultures. Clearly, empirical selection has led to studies resulting in the isolation and use of important active principles and these, together with synthetic derivatives of natural products, are an important source of our therapeutic armament. Nature is still mankind's greatest chemist, and many compounds that remain undiscovered in plants are beyond the imagination of even our best scientists. We hope that by bringing together information gleaned from both cosmopolitan and herbal medicine, we will encourage future discoveries along these lines.

Botanical sources for new drugs may seem endless, but are they? Should man not be concerned with the rapid destruction of our vegetation, particularly in tropical regions containing the greatest diversity of plants, often in limited quantities? Many species may be irretrievably lost now or in another generation. The answer is obvious, but those interested in natural history, conservation, and medicine must do their utmost to prevent the extinction of even a single species that might contain a compound invaluable to man's well-being.

We recognize that our attraction to self-medication has made us vulnerable to exploitation by those who foster the use of natural substances without reasonable knowledge of their scientific value. Therefore it is necessary to take away some of the mystique, dealing objectively with the many facets involved and teaching the reader who lacks medical training the language describing more fully the implications of such activities.

This book may also be used by undergraduate students, particularly those planning medical or paramedical careers and those having an appreciation for natural history and a sensitivity for environmental phenomena. It is based on a course, taught at Washington University by the authors, which lends itself to a team approach with the course master trained in botany. Students having multidisciplinary interests beyond biology and medicine have found the course valuable while studying psychology and anthropology, as have those taking liberal arts and general studies programs. The content of *Medical Botany* provides an interface between the more pre-professional course and that designed for a liberal educational experience.

Plants relating to man's health fall into three categories: those which injure, those which heal and nourish, and those which alter the conscious mind. Our book is divided on this basis into three sections, for normally a plant may be placed in one of these groups with little difficulty. In a minority of cases, however, typical characterization of a plant's activity as injurious, remedial, or psychoactive is questionable; for example, it may depend entirely on the concentration or amount of the plant extract being used. Thus some plants appear in two or even three categories; in these cases, the index should be helpful in locating the organism.

Some compounds that are not wholly natural (semisynthetic) or even synthetic are included, to ensure presentation of a more complete discussion. Very often the synthetic compounds have been patterned after those found in nature, and it seems logical to discuss barbiturates in relation to naturally occurring depressants or amphetamines in any discussion of stimulants.

Generally each chapter introduces the subject through a brief historical account

and/or statistical review; there follows a short, reasonably nontechnical description of the system on which the plant derivatives react, including where appropriate their microbial infections, and also an account of the plants' uses in cosmopolitan (orthodox) medicine both now and in the past. Finally, most chapters contain a section on herbology that describes the plants employed in domestic or indigenous medicine. Usually this is a random sample from the vast array of plants being used domestically around the world, in addition to our emphasis on those utilized by North American Indians. However, this selection in no way implies any particular efficacy. Pertinent research literature concludes each chapter; additional references to broadly useful herbals and medically oriented botanical texts are found in Appendix II.

A difficulty for most individuals reading about many organisms under a single topic is an understanding of what is being included and how the material is organized and categorized. Our broad definition of plants includes not only those which are usually green and are classified into major groups from the seaweeds to the flowering plants, but also those which are not characteristically green. These include the bacteria and fungi. All major taxa referred to in the text are listed in Appendix I beginning with the most primitive forms and ending

with the most advanced plants, all of them flowering. Since the majority of plants with known medical properties are found among this advanced group, we have arranged them in a phylogenetic system, to permit the reader to obtain some idea of their relationship. This may be of considerable practical importance for those interested in compounds common to the plants brought together by this system.

The plants and animals are usually referred to by their vernacular (common) and scientific names, often including both specific (binomial) and familial designations. Authorities for taxa are not given, but the authors for most species included may be found in either *Bergey's Manual of Determinative Bacteriology*, 8th edition, 1974, or JCT Uphof's *Dictionary of Economic Plants*, 2nd edition, 1968.

This book, which is directed to all those concerned with man's health, should be useful to the physician and the biologist and interesting to the layman. We hope that our approach will stimulate worldwide interdisciplinary studies of plants in relation to the health of man.

WALTER H. LEWIS
MEMORY P. F. ELVIN-LEWIS

St. Louis, Missouri
July 1976

Acknowledgments

We wish to express our sincere thanks to Dr. Norman R. Farnsworth, Department of Pharmacognosy and Pharmacology, University of Illinois Medical Center, Chicago, for his thorough and significant review of Chapters 1 through 9. The effort he expended represents an important contribution to *Medical Botany* and we appreciate it exceedingly. Others kindly reviewed individual chapters, and the assistance of the following persons is also very much appreciated: Dr. G. Edward Montgomery, Department of Anthropology, Washington University (Chapter 1, Plants in Medicine); Dr. John M. Kingsbury, Division of Biological Sciences, Cornell University (Chapter 2, Internal Poisons); Dr. Raymond G. Slavin, Department of Internal Medicine, St. Louis University School of Medicine (Chapter 3, Allergy); Dr. Jonathan L. Hartwell, National Cancer Institute, Bethesda, Maryland, and Dr. Robert E. Perdue, U.S. Department of Agriculture, Beltsville, Maryland (Chapter 5, Cancer); Dr. W. Maxwell Cowan, Department of Anatomy, Washington University School of Medicine (Chapter 6, Nervous System); Dr. Thomas A. Scott, Department of Biochemistry, Leeds University (Chapter 8, Metabolism); Dr. Hugh G. Berry, Department of Endodontics, Washington University School of Dental Medicine (Chapter 10, Oral Hygiene); Dr. William R. Fair, Division of Urology, Washington University School of Medicine (Chapter 13, Urogenital System); and Dr. Richard E. Schultes, Bo-

tanical Museum, Harvard University (Chapter 18, Hallucinogens). To all we extend our wholehearted thanks for their expert reviews.

Though many individuals contributed to our task, usually by helping with reference and illustrative materials, we also wish to acknowledge a few in particular: Dr. Raymond E. Altevogt; Dr. William C. Burger (Field Museum of Natural History, Chicago); Richenda E. Crawford; June Croce; Dr. William G. D'Arcy (Missouri Botanical Garden); Faith A. Darnbrough; Dr. W. Hardy Eshbaugh (Miami University, Oxford); Dr. Robert B. Fadeň (Field Museum of Natural History, Chicago); Ross Field Jr.; Olive Gordon; Mary C. Johnson; Dr. Yojiro Kawamura (Osaka University Dental School); Dr. Marilyn Krukowski (Washington University); Lance Lewis; Memoria F. R. M. Lewis; Dr. Alexander R. Lind (St. Louis University School of Medicine); Anita MacBryde; Dr. James Maniotis (Washington University); Dr. Frank L. Mercer (St. Louis College of Pharmacy); Dr. Stephen Molnar (Washington University); Dr. H. Wayne Nichols (Washington University); Clem Okalie; and David W. Pate. Special appreciation is extended to the librarians who helped in so many ways and without whose guidance this book never would have been completed. We cite especially Margaret S. Cummings (Washington University School of Medicine), Betty W. Galyon (Washington University Biology Department), Harriet Steuernagel (Washington University

School of Dental Medicine), Helen Silverman (St. Louis College of Pharmacy), Carla Lange (Missouri Botanical Garden), and Barbara Gibson (Woodward Memorial Biomedical Library, University of British Columbia). Also, without the assistance of those in the Biomedical Communications Service Department, University of British Columbia, the photographic aspects of the book would be meager indeed. This help was both significant and generous.

Finally, we wish to recognize two whose care and patience helped bring *Medical Botany* to fruition. To Lucy Steelman (Department of Biology, Washington University), who typed the manuscript so skillfully, and to Erna R. Eisendrath (Associate Professor Emeritus of Biology, Washington University), who aided us with galley corrections and in other ways, goes our particular gratitude.

In conclusion, we recognize the two universities at which this book was completed: to our alma mater, the University of British Columbia, we thank Dr. William C. Gibson, Department of the History of Science and Medicine, Faculty of Medicine, for generous facilities and many courtesies; and to Washington University, Departments of Biology and Dental Microbiology, we acknowledge wholehearted support over many years of affiliation.

W. H. L.
M. P. F. E.-L.

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Chapter 1

Plants in Medicine

The student and the teacher must always remember that what is new is not necessarily true and what is true is not necessarily new. Perhaps Pope's advice in *Essays in Criticism* (1711) is still applicable:

Be not the first by whom the new is tried
Nor yet the last to lay the old aside.

INTRODUCTION

We can choose no more appropriate people to introduce *Medical Botany* than the North American Indians (Fig. 1-1). The Indian has long been in harmony and partnership with the elements of our natural world, having used them to survive and to embellish his well-being. We chose the Indians of our continent for still another reason, however: today we are seeing an exciting revitalization of interest *in situ* in their ancient traditions of religion, in their language, and in other aspects of their culture. The young are now aflame with newly developed pride in their heritage, while the elderly are encouraged that after a century of indifference to Indian life-style, art, and science, we may be reversing some of the unfortunate attitudes found in the white population as well as among the Indians themselves.

For centuries the Indians have perpetuated an empirical science of herb-



Figure 1-1 North American Indians: approximate original localities of tribes discussed in the text.

ology in relation to health which has been essentially ignored during these days of great advances in biomedicine. We must and can learn what is efficacious in their use of plants.¹ Their healing science program, encompassing traditional spiritual and mythical roles, is both elaborate and lengthy. Apprentices of Navajo medicine men, for example, learn to use medicinally nearly 200 plants, often applying them to both physical and mental afflictions. Substantiated, well-documented cases exist of herbal cures for blood poisoning, rattlesnake bites, and a variety of physical ills we cannot

fully understand. Dealing with psychic phenomena, the medicine man may also obtain remarkable results as yet unexplainable. For example, a peyote user who was diagnosed a schizophrenic was apparently cured after a prolonged treatment involving the hallucinogenic plant *Datura innoxia* while working "with that part of the mind that is outside the person, and that the person doesn't really know about."²

Many Navajo consider that white doctors take care of certain physical needs such as infections and surgery, while their medicine men minister to the major

problems of the mind and spirit. They believe such difficulties to be far more important, for during one's life both harmony and order impart strength and inner peace, which in turn assure physical safety and emotional security.

These medicine men of North America, and their counterparts in Africa (herbalists, witch doctors) and Asia (shamans), are all therapists. They treat patients and obtain results not unlike the formally trained therapists dealing with psychiatry in cosmopolitan or modern Western-derived medicine—the psychoanalysts, psychologists, psychiatric social workers, and trained counselors.³ We often think that the village herbalist is an untrained charlatan working in the realm of magic that in no way relates to science. In the same vein, we also confuse the educational attainments of the practitioner with the therapy—M.D.'s and Ph.D.'s do scientific things, while the "uneducated" do magical things. Yet in Western cultures, mental illness was thought to be primarily caused by witches only a century ago. In other words, it is not difficult to mix a bit of illogic, fantasy, and placebo with the healing science, and at times it may be beneficial. Many people are unaware that much time and effort are expended before an individual is recognized as a herbalist or witch doctor (comparable in indigenous medicines to our pharmacist and psychiatrist), for he must train many years often under several instructors, in one region and then in another, to learn the use of herbs in several localities, the methods of preparation, and how the materials are related to various spiritual rites.

As organized as these local indigenous practices may be (e.g., the Ga Medical Association, Ghana⁴), traditional medicine is nowhere as extensive or as widely accepted as in the People's Republic of China. There, traditional medicinal techniques uniquely involving herbology and

acupuncture have been fused with cosmopolitan medicine to form the New Chinese Medicine.⁵ The Chinese take pride in their indigenous therapies and procedures, and "the advancement of new anti-inflammatory drugs, the bold theory of using purgative in appendicitis in conjunction with herbs and acupuncture, delicate limb and digital connection surgery, the employment of ancient Chinese herbs for the substitution of skin in treating burns, and new experimental techniques and concepts that treat man as a whole entity, all are aspects of the New Chinese Medicine."⁶

Not in harmony but in mutual conflict are the medical practices in the second most populous nation, India, and indeed in much of the Asian subcontinent. Here ancient practices known as Ayurvedic or Hindu and Unani or Muslim medicines, to which the majority of the population turn for assistance, are not treated as in China. By and large, the cosmopolitan trained physicians ignore the practices and teachings of their traditional medicines, which are nevertheless preferred by the population as a whole. This is unfortunate, for much could be shared to mutual advantage. For example, new evidence⁷ of lipid permeability of skin supplies a logical scientific basis for the efficacy of the traditional Ayurvedic techniques of oil and milk herbal massages and partial baths for headaches, rheumatism, and eye ailments.

The widespread and long-standing practice of using plants in medicine in Eurasia, especially around the Mediterranean, the subcontinent, and China,⁸ has been transcribed to us through the pictographs of the Egyptians, the clay tablet ideographs of the Babylonians, and the Vedic Sanskrit, as well as by the verbal communications of the secretive, fraternalistic Greek pharmacist.⁹ Following the contributions to medicine of Hippocrates (460–377 BC), Dioscorides (first

century AD), and Galen (AD 131–200), together with the early Arabian physicians, there was essentially a period of 1000 years during which little if any progress was achieved either in the medicinal sciences or in botany. Original data in botany accumulated during the Middle Ages, however, as plants were grown, new recipes were used, and empirical data were increased—it was the period of the great medicinal herbals.¹⁰ In medicine, the practices of surgeons and barbers became separated during this time. These combined European developments sparked the beginning of Western cosmopolitan medicine. Writings on medicine then were used and read for their content irrespective of the period in which they had been written, for most physicians believed that the experience of the preceding generations had to be assimilated if progress was to be achieved.

This attitude toward the past of medicine changed radically in the second half of the nineteenth century when a new medical science developed and progress was achieved such as never before. The past seemed dead. To the average physician the history of medicine appeared as the history of errors. Nothing could be learned from it; to study it, to read the ancient writers, was a waste of time. Science was worshiped and the best minds turned to the laboratory with great enthusiasm.¹¹

But the biomedical scientist of today who does consider early practices and procedures often finds data important to modern medical therapy and practice, as might be exemplified by the neglected field of ethnomedicine.¹² A combination of data from the empirical method and the most elaborate experimental laboratory and clinical procedures has given us a number of man's most startling and important contributions to the well-being and health of the species.

PLANTS IN MEDICINE

What examples do we have of the correlation between empirical applications and proved efficacy? What examples are there of plant products or their derivatives that directly affect man's well-being? There are a number of important reviews of these questions,¹³ and following the outline of this book, we note a few significant highlights.

There is no doubt that of products harmful to man, those of plant origin are important to everyday life, whether he lives in an urban or rural area in more developed countries, or in the underdeveloped nations. In these various environments are found hundreds of plants that are injurious if ingested and are capable of causing any number of symptoms, including death. People in rural settings, of course, are exposed to nature's lethal organisms every day, but even those in more urban areas must be wary of garden plants introduced from all parts of the world. House plants often are poisonous, and children are attracted to the colorful parts of these otherwise harmless organisms in our midst. Few realize, for example, that apple seeds contain cyanide, which may be lethal in large doses; that the alkaloid taxine from the common bedding plant English yew is rapidly absorbed and causes sudden death; that the leaves and twigs of boxwood, so common as a hedging plant, produce another alkaloid, buxine, which contributes to respiratory failure in humans and domestic animals; that children using peashooters made of elderberry stems may be poisoned from exposure to this plant's alkaloids and cyanide; and that the eating of green and sprouting parts of potatoes may cause severe poisoning. Likewise, common house plants such as oleanders, caladiums, and philodendrons must be avoided, for a person ingesting the leaves of oleander, or its sweet nectar,

may develop severe vomiting, irregular heartbeat, and respiratory paralysis, followed by death.

Hay fever and dermatitis result from an abnormality of our immune system known as allergy. The abundant grasses, trees, weeds, and fungi in our environment produce pollen, spores, and other materials to which we become sensitized so that on reexposure they cause discomforting symptoms that may become life-threatening. No one who has suffered from ragweed hay fever, asthma attacks, or poison ivy dermatitis can doubt the role of allergenic plants in health and productivity.

Certain plants have the disturbing quality of modifying our cells in other ways. Some give rise to mutations that may occur in our reproductive cells, permanently altering succeeding generations if these cells are utilized in reproduction. Others may affect our somatic or body cells in a way that causes congenital abnormalities, resulting in irreparable damage to the fetus. Even more insidious, some plants have the ability to induce cellular aberrations, especially in the peripheral blood; perhaps affecting the immune and clotting systems, and in some instances causing death. Plant proteins, typified by those found in the juice of the poke weed, enter the body through simple cuts and abrasions to do their damage. As a precaution, one should never handle mature poke without gloves.

Of the plants found to have remedial properties, none are more welcomed than those that help in our fight against cancer. How many thousands of lives have been saved or extended by the anti-neoplastic agents of microorganisms, or by the alkaloids vincristine and vinblastine of the Madagascan annual periwinkle. The dramatic results of using these compounds in combination chemotherapy for treating Hodgkin's disease

(80% remission), acute lymphocytic leukemia (99% remission), Wilms' tumor (80% cured), Burkitt's lymphoma (50% cured), and gestational choriocarcinoma (70% cured) are testimonials to the gigantic strides achieved in the past few years when plant products have been introduced against the most terrifying of all disease complexes.

Many plant products affect the nervous system and we, like our forefathers, constantly take advantage of this property in either dulling or exciting the system. Throughout North Temperate America and Eurasia, our ancestors used willows and poplars, which contain an aspirinlike compound, to relieve fever and pain. Eventually we learned that opium alkaloids also relieve pain, and morphine became the all-important analgesic in cosmopolitan medicine. Almost as valuable to the surgeon as his knife are the curare plants (arrow poisons of South American Indians), which reversibly paralyze skeletal muscles and thus make the surgical process more effective.

Our greatest killer is heart disease, but where would we be if the useful properties of foxglove had not been known empirically and then "discovered" by a very astute botanist-physician several centuries ago? The answer should be obvious, since 3 million or more Americans daily take an extract from this plant to stay alive. Without foxglove, or other plants producing cardiotonic compounds, congestive heart failure and death would occur inevitably, and perhaps quickly for most of these people. High blood pressure at one time was also a quick killer. Before 1950 the inflexible fate of those with this disease was a stroke, heart failure, or kidney failure, but today, thanks to the use of *Rauwolfia* extracts, a large percentage of cases of hypertension can be controlled. The ability to lead a reasonably normal and healthy life despite high blood

pressure entails one of the great advances in biomedical research in the twentieth century, yet it stems from an Old World plant long used in Ayurvedic medicine for its tranquilizing effect.

The mystique of what we eat and how our food affects us has been one of man's basic preoccupations. To promote more specific understanding in this area, and to elaborate on the afflictions that may arise from abuse, we have included a chapter on metabolism. In addition to the plants we eat, many plants are useful for alleviating metabolic diseases, such as gout and diabetes, examples of a clear intersection between the empirical method and biomedical research.

The treatment of glaucoma with alkaloids from the calabar bean of Nigeria, or leaves of Brazilian species of *Pilocarpus*, can prevent blindness. These compounds relieve the pressure within the eye by acting on neural receptor sites in that organ.

The oral cavity is of constant concern. When oral disease relates to tooth decay and gum disorders, we might well wonder if preventive dentistry has been adequate, especially when we observe that the teeth of the indigenous peoples of western Africa and southern Asia are free of caries. Recent research suggests that their cleaning implement—nature's toothbrush, the chewing stick—may in fact contain anticariogenic principles. Furthermore, the oil from an Indian chewing stick, when incorporated into toothpaste, has been found to promote the healing of inflamed gums. Such studies, still in their infancy, may reveal new substances that could be used by all to promote dental health.

A bewildering array of efficacious plant extracts appears to be available for the alleviation of most symptoms involving the gastrointestinal tract. Countless plants known to indigenous medicine are used for indigestion and stimulation of digestion, as antispasmodics, emetics, antieme-

tics, purgatives, antidiarrheals, anthelmintics, amebicides, carminatives, and to treat liver complaints and hemorrhoids. In most instances, commercial over-the-counter preparations are also available from the same plants. A recent research development has been the use of two derivatives of *Glycyrrhiza glabra* root, the common licorice from which candy is made, to treat peptic ulcers: ulcers are reduced in size and healing occurs even though the patient is not confined to bed. Licorice has a long history in European domestic medicine for the treating of indigestion and for alleviating (or relieving) inflamed stomachs.

Respiratory diseases include bronchial asthma and emphysema, in which bronchodilators such as plant-derived ephedrine and theophylline are indicated. To clear the lungs of sputum, patients often use expectorants, such as ipecac syrup from *Cephaelis*, creosote from American beech, or mucolytic agents from leaves of the Malabar nut tree. The latter, in very recent clinical trials, has proved efficacious. The vegetable kingdom abounds in antitussive agents, as well as substances utilized in soothing sore throats and treating colds.

Plants have had no greater impact in recent years than in the area of producing substances from which sex hormones are manufactured. They provide the basic steroidal compound for the efficient development of human sex hormones, which are now available cheaply for oral contraception and for treating menopause, improper menstruation, premenstrual tension, and testicular deficiency. Few realize the great contribution made by yams, for example, in stabilizing or decreasing world population, but perhaps no postwar development has been so relevant in changing the lifestyle of those at reproductive age.

Plants are implicated in most folk medicinal aspects of the urogenital system, but none are more extensive than

those involved in sexual drive and performance. Perhaps hundreds of aphrodisiac substances are allegedly used by men of certain indigenous populations. Some are available commercially, such as the alkaloid yohimbine, from the bark of the African *Corynanthe*.

The skin is man's largest tissue, and a great many herbs have cosmetic uses in perfumes, creams, salves, soaps, oils, and shampoos. Important to his survival are plants having properties to stop bleeding and to heal wounds and burns.

Fortunately man has displayed the ingenuity to seek out deterrents, such as the antibiotics, as well as pest inhibitors, to improve his health and often save his life. Great strides in agriculture are intimately associated with pest control, whether it be insecticide, fungicide, or herbicide. Pesticides from natural plant sources, such as the pyrethroids, are preferred because they have low mammalian toxicity and are biodegradable. As we become more sophisticated in our attitude about the environment, we shall undoubtedly increase our use of plant-derived compounds.

As man appears to have long had his aphrodisiacs, whether real or imaginary, he has also had his panaceas. Some of these are imaginary, too, but the star of them all, ginseng, has been shown in recent years to aid the user under stress. Very possibly the millions dedicated to its use have an elixir after all.

Plants having psychoactive properties have always been popular. Stimulants like cocaine, chat, the beverages including coffee, tea, chocolate, and noncaffeine teas, and nicotine, all give a sense of well-being and exhilaration, of self-confidence and even power. They also alleviate fatigue and insomnia. In addition, man found plants capable of inducing hallucinations, ranging from cacti, spices, and morning glories, to mushrooms: he ingested, smoked, and sniffed them, rubbed them on the skin, and even

deified them. But man also has his depressants, which include the widely enjoyed derivative of fungi, alcohol. All such drugs are enormously useful in medicine, but all are subject to abuse.

Many current and ancient texts have been scrutinized in the preparation of the cited examples of plants useful, harmful, and enjoyable to man. From these works we have gleaned what our forefathers learned the hard way and passed on to us. They performed experiments over thousands of years by trial and error, and we with broader insight and scientific expertise have a much greater opportunity to utilize these data than any who preceded us. Valuable data, however, are not always recorded. It behooves us to study the practices of indigenous populations before they are lost, either through human indifference or our relentless ability to change the vegetation around us. We hope that this book will stimulate those interested in botany and man's welfare to look closely and seriously at the field data awaiting our scrutiny.

As a guide to the literature of herbal medicine, we have compiled a list of pertinent herbals, pharmacopoeias, materia medicas, and other types of references relative to medical plants (Appendix II). Remember,

Someone once said that there are but two types of fools: one professes "This is old and therefore is good," and the other says, "This is new and therefore better."

But when judging the medical value of information regarding plants, neither view has a scientific basis.

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