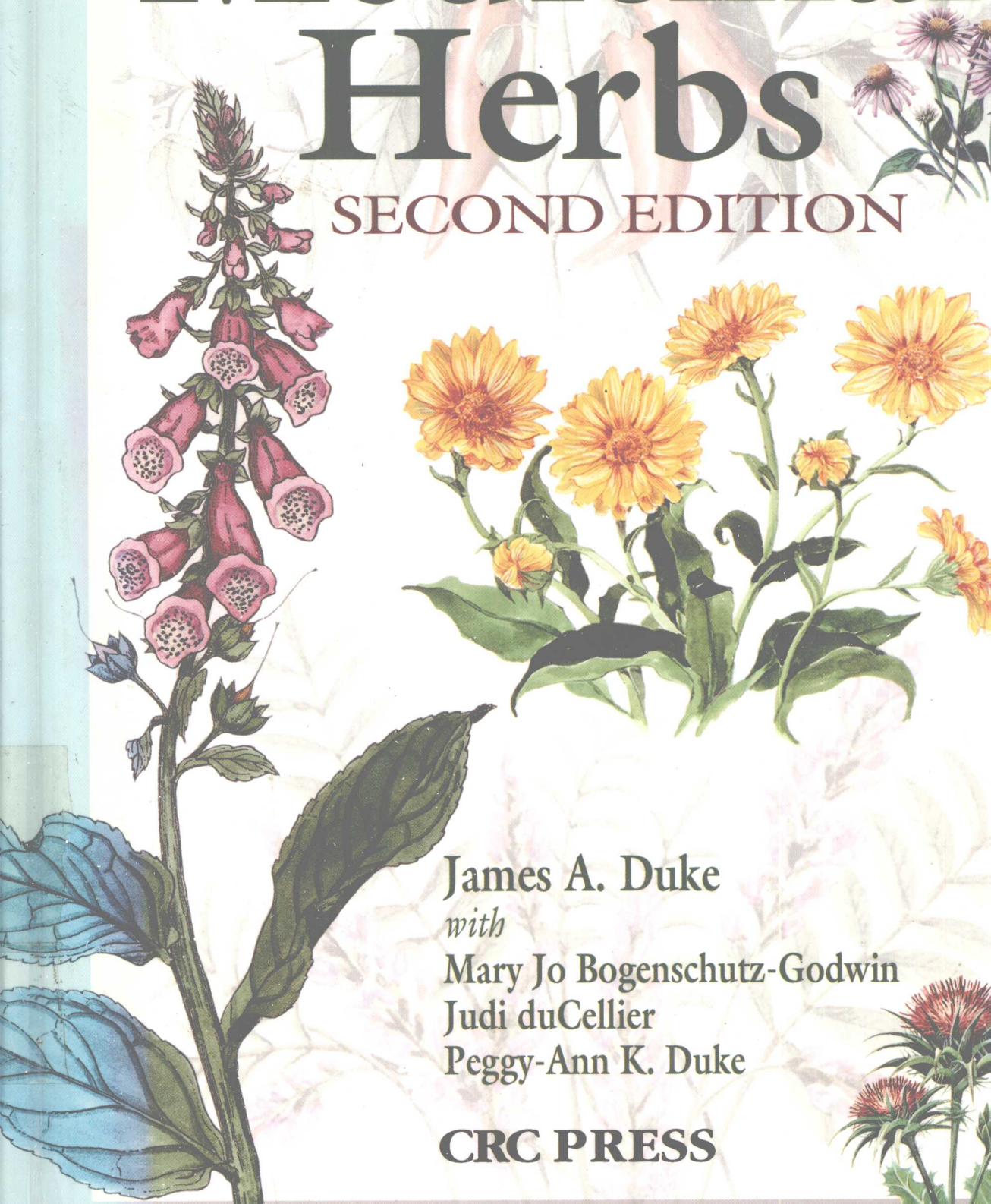
HANDBOOK OF Medicinal Herbs

SECOND EDITION



James A. Duke
with
Mary Jo Bogenschutz-Godwin
Judi duCellier
Peggy-Ann K. Duke

CRC PRESS

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Introduction

By the time this second edition is published, the first edition of the *Handbook of Medicinal Herbs* will have been out more than 15 years. The second edition is designed to present most of the old information plus new information on the more important of those original 365 herbs. I submitted the first edition under the original unpublished title, *Herbs of Dubious Salubrity.* I intentionally left out many of the completely safe culinary herbs, spices, and food plants that are clearly medicinal. I also intentionally omitted some strictly dangerous herbs, such as foxglove, that were too unhealthy for use in unskilled hands. I did include several obscure hallucinogenic plants of dubious salubrity. I did, or should have, dropped some of these because they have little medicinal importance. Some poorly documented species, such as *Mimosa hostilis* and *Phoradendron leucarpum*, for example, were retained with fragmentary entries, so as to at least mention species from the first edition that might better have been dropped.

Now I think I have the most important herbs well covered here. In edition two, which I will refer to frequently as my Herbal Desk Reference (HDR), I have tried to concisely corral the data on some 1000 herbs in as little space as possible, striving to make a reliable, referenced resource to parallel the *PDR for Herbal Medicines*. I use the three-letter abbreviation, HDR, to indicate the second edition of my *Handbook of Medicinal Herbs*, because I compare and contrast it to other important sources, which are also represented by three-letter abbreviations. (See the reference abbreviation appendix.)

With this edition, I have tried to cover most of the widely mentioned medicinal plants, whether they are extremely salubrious or extremely toxic. Without counting them, I estimate we include more than 1000 of the most important herbs, including the more important herbs from the young Native American and the European traditions (including most of those approved by Commission E (KOM), and almost all of those included in the *PDR for Herbal Medicine* (PHR for the first edition, and PH2 for the second edition). Unlike Commission E and the Herbal PDR, which seem to stress European and American traditions, I include proportionately more herbs from the older African, Ayurvedic, and Chinese traditions as well, not wanting to slight any major medicinal plant from any major tradition.

Let me explain the new format for the second edition. First, a common name appears, usually but not always in English, followed by a recently accepted scientific name, with the authority for the scientific name. Then follows a safety score, X, +, ++, or +++. An X means I don't recommend taking it at all, or realize that it is so dangerous that it should not be taken without expert guidance. But for litigious reasons, I give some potent medicinal herbs the X (amateurs beware!). A single plus (+) indicates that I do not consider that the herb is, overall, as safe as coffee. I score two pluses (++) for those herbs I think of, overall, as being as safe as coffee. I score three pluses (+++) for those herbs I believe to be safer than coffee. In the first edition, I related the plus sign to a cup of coffee, figuring that 1, 2, or 3 cups per day of an herbal tea from the herb would be as safe as 1, 2, or 3 cups per day of coffee. I often drink more than 3 cups of coffee a day, especially while I worked on this project! Clearly, this is an oversimplification. Too often, some parts of a plant are more helpful or more toxic than other parts of the same species, and different ethnic groups or cultures may use parts differently. The safety scoring is a continuation of the same scoring system I used in the first edition. Some scores have been upgraded a bit, some have been downgraded.

Often, there are some comments on synonymy and other nomenclature difficulties that arose in completing this opus. I inject these following the nomenclature line. Here you may find some proven and/or suspected synonyms, or notes of related species that may be included in this species

concept, especially by nontaxonomically trained authors. I have often used, as final arbiter of scientific names and sometimes common names, the nomenclature database at the USDA (www.ars-grin.gov; curator, Dr. John. H. Wiersema: sbmljw@ars-grin.gov).

Unfortunately, the new American Herbal Products Association (AHP) book on nomenclature arrived too late for our consideration. Attempts to standardize common names, although admirable, are often aggravating to special interests. It was with some misgiving that I arranged this book alphabetically by common names, when the first edition was by scientific name. It generated big headaches for all of us who think more along the lines of scientific names. Would it be under mulberry or black mulberry, chamomile or German chamomile? Some plants have dozens of common names. Several have suffered almost as many scientific names, such as, for example, feverfew. Hopefully, you will find it easy to use.

In the Activities and Indications sections, parenthetical numbers are followed by three-letter abbreviations (abbreviation of source) or an alphanumeric X-1111111 to identify PubMed citations. A parenthetical efficacy score of (1) means that a chemical in the plant or in an extract of the plant has shown the activity or proven out experimentally (animal, not clinical) for the indication. This could be *in vitro* animal or assay experiments. A hint: not real human proof! Nothing clinical yet! I give it a score of (2) if the aqueous extract, ethanolic extract, or decoction or tea derived from the plant has been shown to have the activity, or to support the indication in clinical trials. Commission E (KOM) and Tramil Commission (TRA) approvals were automatically given a score of (2) also, because they represented consensus opinions of distinguished panels. The rare score of (3) for efficacy means that clinical trials exist to show that the plant itself (not just an extract or phytochemical derivative) has the indications or activities. The solitary score of (f) in many of the citations means it is unsupported folk medicine, or I have not seen the science to back it up. The three-letter abbreviations are useful short citations of the references consulted in arriving at these numbers. I have by no means cited every source. However, unlike KOM and hopefully better than PHR, we indicate at least one source for every indication and activity we report.

Thus, we have a score for Safety and a score for Efficacy, the latter backed up by the three-letter abbreviations or citations, often PubMed citations. In addition to our three letter abbreviations for the frequently consulted texts, we occasionally cite articles cited from the PubMed database with their unique abstract number, preceded by the letter X. For example, I received a paper showing that ginger contained several COX-2 inhibitors. I looked in the PubMed database to find the unique abstract citation number, PMID: 11437391, which I shortened for database purpose to X11437391. So, all alpha-numeric (X-numerical) combinations will refer you to the source in the PubMed database. Whenever I update one of my Herb-a-Day columns, I automatically search PubMed for >species name AND 2000 <, which automatically gives me the post 1999 abstracts. In 2001, I search for >species AND 2001<. Then I order hard copies of those articles that look promising for database purposes.

Often, many more than 10 sources were involved in my decision-making. In many instances, I limited citations to three, typically the ones that were most important at arriving at my scores. Not wanting to blow my own horn, my own books were first to be deleted from the list when it exceeded three. In preparing this edition I realized that for patent litigation, the earlier citations were most valuable, so at the last minute I added several older references, such as DEP, FEL, HHB, and MAD. For example, even I was surprised when I read about Remifemin in HHB (1973, p. 12), three decades ago, since Remifemin seems so new here in America. But in my mind it is just another native American remedy, coming back home to us, slightly upgraded, after having been better studied in Europe than it has been in America (other examples include evening primrose, passionflower, and saw palmetto). DEP and FEL citations are more than 100 years old, and might be useful in challenging frivolous patents.

One very important abbreviation, WAM, might as well be viewed as MOM, meaning pediatric. This comes from the excellent book, *Kids, Herbs, Health*, by Dr. Linda White, MD, and Sunny

Mavor. So, if you are looking for an herb that has been suggested by a pediatrician, scroll down to WAM. Ditto for PIP, Hans Schilcher's *Phytotherapy in Paediatrics*.

This is an evolving system that changes as new science validates the folklore, often resulting in an upgrading of the indication or activity. Occasionally, bad news about the plant will result in my lowering its safety rating, from +++ to ++, or ++ to +, or + to X. This does not constitute my recommendation of an herb. It merely indicates how I think the herb compares with others, based on the literature surveyed. As a botanist, I cannot legally, and do not, prescribe. But I find mechanical searches of the *Handbook of Medicinal Herbs* to be an extremely fast way to find the better herbs for a given indication.

We have used the same abbreviations that are used in my database at the USDA (http://www.ars-grin.gov/duke). I much prefer the abbreviations used there because they do not get you into as much trouble when you e-mail a query to the taxpaying public. For example, the preferred abbreviation of microgram, at least with some publishers (including CRC), but not me, is µg. Too often, if I put that abbreviation (or use an italicized *u*) in an e-mail, the *u* or µ disappears and the reader receives g instead of *u*g or µg, giving an often dangerously high reading, a million times too high. Ditto for *u*l or µl (microliter) as opposed to ml (milliliter). And with *uM* and m*M*, micromole and millimole, respectively.

In a sense, my scored second edition is a loner's approach to a Commission E, but I am the sole member of the fictitious commission, Commission U.S. for us, here in the good old USA. Note that unlike the ratings in, for example, APA, my ratings assess the efficacy of each activity and indication.

I'll keep revising the scoring for an online version as new information, positive or negative, comes in on the safety or efficacy of the herb, or chemicals it contains. So, like the allopaths, health announcers, and reporters, I reserve the right to change my mind as I oscillate from side to side of the pendulum on my long, tedious, treacherous, and tumultuous trip, veering like a coiled caduceus, deviously toward the truth.

Users will find it easy to search and find which herbs score highest for efficacy and safety. The three-letter abbreviations will lead them to some, but by no means all, of the sources I consulted including the one(s) or some of them that led me to the numerical scores for efficacy. The scores are my own. Only rarely did all the cited and consulted sources agree; but one of the indicated sources provided the evidence that led me to arrive at the assigned score. By no means should these scores be attributed to anyone except me.

THE APA RATINGS

A warning: my highest ratings are my best ratings. With the American Pharmaceutical Association (APA) and the American Herbal Products Association (AHP), the converse is true: the higher the number, the lower the rating. APA's best, (1), is verified by large clinical, randomized, placebo-controlled, double-blind, human trials. That too would have gotten approval, we assume, in Commission E. That would get a (2) in my HDR, if the study were of an extract of the plant, but a (3) for example if the study were of the natural whole herb, such as garlic or onion. The APA (1) and the HDR (3) scores are rare indeed. Their number (1) means "Years of use and extensive, high-quality studies indicate that this substance is very effective and safe when used in recommended amounts for the indication(s) noted in the 'Will It Work For You?' section." Unfortunately, they often mention unapproved, unstudied folklore in this section, even clearly noting that it was unapproved. With APA, (2) is a large, clinical human trial, but not necessarily double blind and placebo controlled. That would also get a (2) in my HDR, if the study were of an extract of the plant, but a (3) if the study were of the whole herb, rather than the extract. And the third one is hard for me to believe, but here is the quote, "large, placebo-controlled animal experiment." That would get a (1) in my HDR. The APA (4) is for *in vitro* studies, which I suppose includes studies, e.g., of isolated phytochemicals. Those score (1) in HDR. The APA (5) is for decades or centuries of well-known folk use, but no supporting studies. That would get an (f) for folkloric in the HDR. APA (6) is a large collection of case histories, which

would also get an (f) in HDR. At the bottom of the APA ladder is the personal anecdote, which of course, also gets an (f), even though it has not yet evolved into folklore.

THE AHPA CLASSIFICATION

A few specific comments regarding the American Herbal Products Association (AHP). Although I like the way they handled some perplexing little details, such as idiosyncratic allergies, trivial quantities of toxic substances, etc., I'm a little alarmed by their 'Class 1' definition. Why alarmed? Because I feel that all drugs, whether they be synthetic, phytochemical, nutritional, or herbal, "can be safely consumed when used appropriately."

Class 1: Can be safely consumed if used appropriately.
Class 2: Herbs with the following use restrictions apply; unless otherwise directed by an expert qualified in the use of the substance:
(2a) External use only
(2b) Not for use in pregnancy
(2c) Not for use while nursing
(2d) Other restrictions as noted
Class 3: Herbs with significant data suggesting labeling: "To be used only under the supervision of an expert qualified in the appropriate use of this substance." Labeling must include proper use information: dosage, contraindications, potential adverse effects and drug interactions, and other information pertinent to the safe use of the substance.
Class 4: Herbs with data insufficient for classification.

Why don't I like that 'Class 1' definition? My interpretation of 'Class 1' definition is that all herbs are 'Class 1' and can be safely used if used appropriately (appropriate is safe). Similarly, I think we could say appropriately for many, if not most, herbs what AHPA says of labeling information that should be required for aloe, "Do not use this product if you have abdominal pain or diarrhea. Consult a health care provider prior to use if you are pregnant or nursing. Discontinue use in the event of diarrhea or watery stools. Do not exceed recommended dose. Not for long term use." (AHP, 1997)

A subset of American phytomedicine advocates argue that we should emulate the German Commission E's Standard of Excellence. Which one? Two versions came out in 1998, purporting to be authentic English presentations of the Commission E conclusions. There were some differences; e.g., Blumenthal's very careful book (identified as KOM in this book) states that hyssop is unapproved by Commission E, while Gruenwald, in the second edition of the *PDR for Herbal Medicine*, says hyssop is approved for colds, fevers, and gallbladder and liver complaints. In the title line, where I evaluate safety, I scored hyssop with three pluses (+++), meaning that I think it is safer than coffee as an herbal medicine. As to efficacy, I had decided to let Commission E endorsement rank 2 in my Activities and Indications columns.

This example of divergence between the published "Commission E" interpretations of hyssop (and there are more than ten English interpretations of Commission E now) is just one of many that I encountered as I traversed most of these interpretations. It really raises a serious question again that I raised for myself back in the early 1980s as I was working on my *Medicinal Plants of China*. Clearly, I was capable of working only with the English translations of Chinese books on medicinal plants, embellished by three trips to China. I assumed that by the time I had compiled most of the information from five different books, there would be little new information as I traversed the sixth. But diminishing returns had not yet set in. There are a few major discrepancies in recent translations of romance language, scientific German, as with Commission E. How many more can we expect in translations of ancient Chinese, Hindu, and

Sanscrit writings that are thousands of years old? Small wonder we often encounter differences of opinion.

One can only be thankful that these books have survived because they document millennia of empirical wisdom. The best of the herbal medicines have survived and the worst have been marginalized. That took thousands of years. You can almost say the same of pharmaceuticals: some have survived, while some of the worst have been marginalized or withdrawn. But none of the pharmaceuticals have survived more than 200 years with us. But the ~140 herbs mentioned in the Bible have been with us 2000 years. A recent study showed that humans have been active in the Biblical area for at least 1,700,000 years. So, the genes of some humans have experienced many of the phytochemicals from Biblical plants for nearly 2 million years. More new synthetics hit the market each year, to your peril, but few new herbs surface in a given year. Mankind does not want bad medicine. Man empirically selects the good and rejects the bad. I feel strongly that many of the herbs treated in this book are as good as the competing synthetic pharmaceuticals, and almost always cost less, in dollars and in side effects. Until the better of these herbs have been clinically compared with the pharmaceuticals, neither your physician nor mine, nor you nor I, knows for sure which is best. Meanwhile, pharmaceuticals will kill more than 100,000 Americans a year, as per *JAMA*, a propharmaceutical journal, while herbs will kill fewer than 100, as per the conservative *Washington Post* in an antiherb article (Gugliotta, March 19, 2000). On May 1, 2002, the *Journal of the American Medical Association* (*JAMA*) suggested that adverse drug reactions may be the leading cause of death in the United States.

FORMAT

SYNONYM: In some cases I list one or more taxonomic synonyms often following the USDA Nomenclature database, curated by John Wiersema http://www.ars-grin.gov/npgs/tax/taxgenform.html.

ACTIVITIES: Most of the published biological activities that crossed my desk are listed alphabetically, with each activity followed by the "f" or numerical score for efficacy, followed by the citation for the source.

INDICATIONS: Most published indications that crossed my desk are listed alphabetically, with each indication followed by the "f" or numerical score for efficacy, followed by the citation for the source. It was with some trepidation that I converted more specific terms such as arthritis to arthrosis, and bronchitis to bronchosis, but I think that was a more economical (space-wise) way of presenting the data. Classically, the suffix "itis" means inflammation, and "osis" means ailment of. Thus, arthritis is inflammation of the joint, and arthrosis is broader, meaning an ailment in the joint. Where some author just said "for joint problems," that became "arthrosis," but where they were more specific and said inflammation of the joint, it means the more specific "arthritis." Toward the end we aggregated both under "arthrosis." Many people will dislike that I converted all the more specific -itis entries to -osis, rather than somewhat redundantly include both.

DOSAGE: I have attempted in this edition to give the range of published dosage ranges I have encountered. With good editorial prodding, I have gone back to my sources to see if they specified which plant part. In some cases my sources were not specific as to plant part. And sometimes one source specified one part, another source identified another part. A few dosages were taken right off the bottles of herbs. If there are dangerous published dosages given under dangerous herbs, I have indicated with an "X" that it should not be taken except with a skilled practitioner on hand. None of the dosages originate with me (except for an occasional "food farmacy" comment, indicating that the herb is eaten as food); they are from the literature, as indicated by the usual set of abbreviations. Several do, however, represent dosages said to have been approved by Commission E, especially those cited with the abbreviations KOM, PHR, and PH2. I suppose by appearing in

an American Pharmaceutical Book, there is an indirect assumption that APA approves those APA data, but I am not sure they would give such approval.

CONTRAINDICATIONS, INTERACTIONS, AND SIDE EFFECTS: The scores of AHP, PHR, and PH2 are cited followed by some of the reported perils of the herbs, indicated by the usual three-letter or abstract citations giving the source of the warning regarding the "peril."

EXTRACTS: More than 20 years ago, I started a phytochemical database that gives many of the published activities of the bioactive phytochemicals. I regret at that time I had no systematic approach to scoring the activities of the extracts of the plants. That is what we usually take, rather than isolated phytochemicals. So, occasionally, too late, I have included some reports on activities (and ED50's and LD50's where available) on various extracts of the plants. We have at the last minute deleted the repetition of the extensive data found in my updated FNF phytochemical database, early versions of which were published in some of my previously published CRC books.

Duke, J.A. *Handbook of Phytochemical Constituents in GRAS Herbs and other Economic Plants.* CRC Press, Boca Raton, FL, 1992.

Duke, J.A. *Handbook of Biologically Active Phytochemicals and Their Activities.* CRC Press, Boca Raton, FL, 1992.

Beckstrom-Sternberg, S. and Duke, J.A. *Handbook of Mints (Aromathematics): Phytochemicals and Biological Activities.* CRC Press, Boca Raton, FL, 1996.

Where I found no significant information for any one format section, the headings were deleted, therefore, many entries will have only e.g., Activities and Indications.

Readers who wish to know more about the individual phytochemicals occurring in a given herb can find many useful queries answerable on my USDA database: www.ars-grin.gov/duke.

In one particularly useful query for a person trying to rationalize the utility of an herb, one can secure a list of all the phytochemicals reported from the plant, with or without the list of all their reported activities, even calling out a primary or secondary reference for each data bit. Printouts of such queries on the better-studied plants are often dozens of pages long, and impractical to publish in this edition. It becomes increasingly clear that there are hundreds of biologically active compounds, often additive or synergistic, in all our plants, foods, spices, herbs; medicinal and poisonous plants alike. The genes directing the thousands of chemicals in our own body have coevolved with all or many of the phytochemicals in most of the edible plants that our ancestors chose to eat and the medicinal plants with which they treated themselves. My genes have probably known thousands of phytochemicals now extant in the Rift Valley (where anthropologists speculate that humans evolved some 6 million years ago), and still extant in my American herbs. I feel that homeostatic mechanisms have evolved for these long-known phytochemicals, enabling the body to grab a needed chemical in which the body is temporarily deficient and, conversely, excluding perhaps as "expensive" urine, those phytochemicals in which the body is not deficient. Yes, I even agree with "supplement-bashers," who charge that excess vitamins are often excreted, unused, in the "expensive" urine. I am inclined to disagree if the basher suggests that most of us are not deficient in one vitamin or another. I think the majority of, if not all, Americans are deficient in one or more vitamins that occur in dietary plant sources. Only within the last decade did we finally realize that choline was essential. I think more such knowledge will surface in the decades ahead. And we will learn that such common and useful phytochemicals as oleanolic acid, procyanidins, quercetin, resveratrol, and sitosterol are often needed by the body and, like vitamins, kept within bounds by homeostatic mechanisms. When you offer your body an herbal menu of hundreds of useful synergistic phytochemicals, your body may select those it needs most, rejecting the ones least needed or not needed at all. When you offer the body an isolated phytochemical or synthetic pharmaceutical "silver bullet," you are excluding all those hundreds of other useful phytochemicals in the edible and medicinal herbs. Your body knows better than your pharmacist or physician or phytotherapist or shaman, which chemicals it needs. And your evolutionary

diet will often provide chemicals in which you may be temporarily deficient. Your evolutionary diet included a wide variety of plant materials that are no longer generally consumed. And your body, if not your brain, will recognize a positive benefit therefrom. The safer herbs will prevail, in spite of mounting published efforts to make them seem more dangerous than the pharmaceuticals. Herbs, on average, are much cheaper and safer than pharmaceuticals, and often as efficacious.

ILLUSTRATIONS: Mrs. Peggy Duke, my most vociferous critic, has generously rounded up nearly 250 black-and-white illustrations and several color plates bearing her copyright. This is a substantial improvement over the first edition. Peggy's black-and-white illustrations are located with the herb under discussion. Thanks to the benevolence of Natures Herbs, A Twinlab Division, we are able to include ~150 color plates of most of the popularly marketed herbs in the U.S. We give special thanks to Grace Lyn Rich and Steve Welling for making this possible.

I hope the second edition of the *Handbook of Medicinal Herbs* will help patients and physicians alike to use the safer herbs even more safely and wisely, and help steer them to the safer herbal alternatives and away from some of the more dangerous pharmaceutical alternatives.

James A. Duke

Acknowledgments

Although this second edition is clearly the work of many people, I use *I* in the introduction, and acknowledgment and often in the text. There is no shorter, less ambiguous word in the world than the word "I." I could have said "the author" or "the authors" instead of "I" or "we" and really introduced ambiguities, but my coauthors don't share all my views, so the buck stops here. I acknowledge with deep gratitude and with apologies, my coauthors: Mary Jo Bogenschutz-Godwin, who has worked with me more than a decade, rewriting from my terrible sows-ear drafts to produce the proverbial silk purse; Judi duCellier, who has worked with me 25 years and survived the evolution of my creeping dyslexia; Peggy-Ann Kessler Duke, friend for nearly 50 years and wife for more than 40; botanical illustrator par excellence, whose more than 300 illustrations are worth more than my 300,000 words; and to CRC Press publisher, Barbara Norwitz, who for more than 5 years has seen me slip and slide in and out of proposed contracts to do this second edition. To these praiseworthy women accrue all the compliments for this massive volume. The errors are mine.

All science books are built on what has gone before, hopefully seizing the best and discarding the worst. It's not plagiarism if one cites one's sources. I am deeply indebted to all those scientific writers with and before me, who have written about phytochemicals and phytopharmacy; and to our ancestors before them, who sampled the plants around them, and learned which were edible, medicinal, and poisonous, and who lived to talk about it.

Also let me acknowledge you, my readers, for struggling with this, my most ponderous, yet I hope most useful, book. If you like it and find any errors, let me know. I hope to keep it updated on my computer at home. Then maybe Barbara and CRC Press, maybe even you, will be ready for a third edition. New scientific data are pouring in, hopefully proving me right, that herbal phytochemicals are cheaper and safer, on average, and often as efficacious, as competitive pharmaceuticals.

James A. Duke

The Author

James A. "Jim" Duke, Ph.D., is a Phi Beta Kappa graduate of the University of North Carolina, where he received his Ph.D. in Botany. He then moved on to postdoctoral activities at Washington University and the Missouri Botanical Gardens in St. Louis, Missouri, where he assumed professor and curator duties, respectively. He retired from the United States Department of Agriculture (USDA) in 1995 after a 35-year career there and elsewhere as an economic botanist. After retiring, he was appointed Senior Scientific Consultant to *Nature's Herbs* (A Twin Labs subsidiary), and to an online company, ALLHERB.COM. He currently teaches a master's degree course in botanical healing at the Tai Sophia Institute in Columbia, Maryland.

Dr. Duke spends time exploring the ecology and culture of the Amazonian Rain Forest and sits on the board of directors and advisory councils of numerous organizations involved in plant medicine and the rainforest. He is updating several of his published books and refining his online database, http://www.ars-grin.gov/duke/, still maintained at the USDA. He is also expanding his private educational Green Farmacy Garden at his residence in Fulton, Maryland.

Abbreviations

Full reference citations are listed in the References section. Many of our primary reference citations follow the consistent system (abbreviation, volume, page) format developed in my *CRC Handbook of Biological Activities*. These are more meaningful to us, the compilers, than the PMID abstract number (e.g., EB, or JE, or PR followed by a number then a colon then another number, always means *Economic Botany, Journal of Ethnopharmacology,* or *Journal of Phytotherapy Research,* respectively, followed by the volume number:page number).

The major references in this edition are indicated by concise and consistent three-letter abbreviations. The short explanation in the alphabetical sequence for the often-used three-letter abbreviations for our major references appear in the Reference Abbreviations section. Many primary sources are often cited via the PMID index, which is indicated by an X, followed directly by the PubMed serial number. Even for the $3000 worth of journals to which I subscribe, I can usually find the PubMed citation in the same week that the journal gets my citation.

Conventional abbreviations appear here. Three types of citations, compactly squeezed into the all important Activities and Indications paragraphs, are generously sprinkled elsewhere.

ABS abstract
ACAT Acyl-CoA: cholesterol acyltransferase
ACE angiotensin converting enzyme
AChE antiacetylcholinesterase
ADD attention deficit disorder
AFG in Afghanistan, as based on KAB
AHH arylhydrocarbon hydroxylase
AHP American Herbal Products Association
AIL Duke's computerized AILS file, source of *The Green Pharmacy*, etc.; soon to be online
ALA alpha-linolenic acid
AMP adenosine monophosphate
APA American Pharmaceutical Association
APB as-purchased basis
ARC Aloe Research Council
ATP adenosine triphosphate
BAL Baluchistan, as based on KAB
BO body odor
BPC British Pharmacopoeia
BPH benign prostatic hypertrophy
cAMP cyclic adenosine monophosphate
cf compare with
CFS chronic fatigue syndrome
CHD coronary heart disease
chd child
ckn chicken
CNS central nervous system
COM commercial
COMT catechol-O-methyl-transferase
COPD chronic obsessive pulmonary disorder
CORP corporation
COX cyclooxygenase
COX-I cyclooxygenase inhibitor (sometimes COX-1 or COX-2)
COX-2-1 COX-2-inhibitor
CVI chronic venous insufficiency
DGL deglycyrrhizinated licorice
DHT dihydrotestosterone
DMBA 7,12-dimethylbenz[a]anthracene (a carcinogen)
dml dermal
EBV Epstein-Barr virus
ED50 effective dose at which 50% of subjects are "cured," "effected," "affected," or "altered"
e.g. for example
EO essential oil
EPA eicosapentaenoic acid
EPO Evening Primrose oil
ERT estrogen replacement therapy
etc. et cetera
ext extract
f folklore, not yet substantiated
frg frog

g gram
GA glycyrrhetinic acid
GABA gamma-amino-butyric acid
GC *Garcinia cambogia*
GERD gastroesophageal reflux disease
GFG green farmacy garden
GI gastrointestinal
GLA gamma-linolenic acid
GMO genetically modified organism
gpg guinea pig
GTF glucosyl-transferase
h (as a score for an activity or indication) homeopathic
HCA hydroxycitric acid
HCN hydrocyanic acid
HDR *Herbal Desk Reference*; online version under my Medical Botany Syllabus (MBS)
HFR human fatality reported
HLE human leukocyte elastase
HMG hydroxymethylglutarate
hmn human
HRT hormone replacement therapy
iar intraarterial
IBD inflammatory bowel disease
IBS irritable bowel syndrome
IC inhibitory concentration
ICMR Indian Council of Medical Research
ID50 inhibitory dose at which 50% of activity is inhibited
IgE immunoglobulin-E
igs intragastric
ihl inhalation
IL interleukin
ims intramuscular
inc incorporated
ind intradermal
inf infusion
ipr intraperitoneal
ith intrathecal
ivn intravenous
LD50 lethal dose at which 50% of experimental population is killed
LDlo lowest reported lethal dose
lf leaf
l liter
MAOI monoamine oxidase inhibitor
MDR multidrug resistant
mg milligram
MIC used differently by various sources; minimum inhibiting concentration or mean inhibiting concentration
mky monkey
ml milliliter
MLD used differently by various sources; Merck meaning minimum lethal dose; some other sources meaning mean lethal dose, and some do not define it (with apologies to the reader from the compiler)
m*M* millimole
MMP-9 matrix metalloproteinase-9
mus mouse
NH3 ammonia
NIDDM noninsulin-dependent diabetes mellitus
NKC natural killer cell
NO nitric oxide
NWP Northwest Province or Pushtu (dialect at border of northwestern Afghanistan)
OCD obsessive compulsive disorder
ODC ornithine-decarboxylase
OPC oligomeric procyanidin
ORAC oxygen radical absorbance capacity
orl oral
OTC over the counter (or approved for sale in Europe)
oz ounce
PA pyrrolizidine alkaloids
PAF platelet aggregating factor
par parenteral
pc personal communication
PEITC phenethylisothiocyanate
pers. comm. personal communication
PG prostaglandin
pgn pigeon
PKC protein kinase C
PMS premenstrual syndrome
pp pages
ppm parts per million
PSA prostate-specific antigen
PTK protein tyrosine kinase
rbt rabbit
RSV respiratory syncytial virus
RT reverse transcriptase
SAD seasonal affective disorder
SAM S-adenosylmethionine
scu subcutaneous

SF Stephen Foster
SGPT serum glutamic pyruvic transaminase
SL sesquiterpene lactones
SLE systemic lupus erythematosus
SN serial number (when followed by a number)
SOD superoxide dismutase
SSRI selective serotonin reuptake inhibitor
sup suppository
TAM traditional Ayurvedic medicine
tbsp tablespoon
TCM traditional Chinese medicine
THC tetrahydrocannabinol
TNF tumor necrosis factor
tsp teaspoon
unk unknown
uns unspecified
UTI urinary tract infection
UV ultraviolet
VD venereal disease
VEGF vascular endothelial growth factor
VOD veno-occlusive disease
Vol volume
wmn woman
WPW Wolff-Parkinson-White (syndrome)
X solitary X in the title line of the herb following the scientific name means do not take it without advice from an expert (think of it as a skull and cross-bones)
X followed by serial number PMID (PubMed ID number)
XO external use only
ZMB zero moisture basis
µg microgram
µl microliter
µM micromole

Contents

Catalog of Herbs (A to Z) 1

Reference Abbreviations 815

References 821

Illustration Credits 829

Scientific Name Index 831

Common Name Index 843