16

Herbs and "Health Foods"

LEGALITY OF SALE

Recently, the American public has renewed its interest in the self-treatment of disease states or less-than-optimal health conditions with various products of natural origin which, for reasons to be explained later, are referred to as herbs or "health foods" but not as drugs or medicinal agents. This interest has resulted in the development of a large number of retail outlets and mail-order houses specializing in the distribution of these and related commodities. Their sales amounted to nearly $1.7 billion in 1985. This enormous development took place while most crude vegetable drugs were disappearing from the stocks of pharmacies and from the purview of pharmacists. The causes of this seemingly anomalous situation are found in the laws and regulations that apply to the marketing of drugs in the United States today.

The 1938 Federal Food, Drug, and Cosmetic Act, which had initially required all drugs sold in this country to be proved safe, was amended in 1962 following an extensive Congressional investigation of the drug industry led by the late Senator Estes Kefauver. The 1962 Drug Amendments (commonly referred to as the Kefauver-Harris Amendments) required that drugs marketed after 1938 be proved both *safe* and *effective*. This requirement led to a new era of drug regulation.

Drugs introduced after 1938 had been proved safe by a procedure known as a New Drug Application (NDA). To determine the effectiveness of such drugs, the Food and Drug Administration (FDA) turned for help in 1962 to the National Academy of Sciences—National Research Council. That group, in turn, organized a "Drug Efficacy Study," which was completed and submitted to the FDA in 1969. Then, in 1972, the FDA proposed an additional review of all drugs available for self-selection by the patient. Only a small number of these over-the-counter (OTC) drugs had been included in the original NAS-NRC study. But the problem, from the regulatory viewpoint, was how to make this review apply to some of the older products that had been "grandfathered" under the 1962 and the 1938 laws because they came under the jurisdiction of the original 1906 Food and Drugs Act. All such drugs were seemingly immune from the "effective" requirement.

The FDA reached these "grandfathered" drugs by what can only be characterized as an extremely innovative application of administrative law. The agency declared that a drug would be considered misbranded if the manufacturer made any claims for it

that were not in accord with the findings of 1 of 17 panels set up to review the efficacy of the active ingredients of all OTC drugs. In other words, the drug, even though exempt from proofs of safety and efficacy under existing laws, was barred from commerce if any part of the labeling claimed that the drug was "good" for anything, that is, "effective" for the treatment of a disease state. Substantive evidence of efficacy must be available to permit a labeling claim of therapeutic utility. Statistically designed, clinical, double-blind crossover studies are rarely available to support claims for crude plant materials. The pharmaceutic industry has shown little interest in sponsoring such studies and has not submitted alternate types of supporting data in most cases.

This has led to the curious situation in which essentially all of the old-time plant drugs have been removed from the shelves of pharmacies and from the supervision of knowledgeable pharmacists. Selling drugs that ostensibly have no use violates the ethical code of pharmacists. But such plant drugs have not ceased to be sold or used. Instead they have found their way into the stocks of the retail or mail-order "health-food" stores where, under the guise of herbs, teas, health foods, food supplements, nutritional products, or the like, they are labeled only with the name of the product. No claim of effectiveness for any condition appears on the label of such containers nor does it appear in any leaflet or advertisement that directly accompanies the drug because that would technically qualify as part of the labeling (Fig. 16–1). Sales staff generally avoid specific recommendations on use of a product to preclude potential charges of unlicensed practice of medicine. However, if a customer wishes to know the use of a particular drug, the "health-food" store clerk or mail-order catalog will refer him to a large selection of books, pamphlets, and charts that list the drugs and provide the sought-for information. Some of these information sources are referred to as herbals, or as natural medicine or health-food books; others are devoted to a single drug; and still others employ a therapeutic classification, listing the disease state and describing the products recommended for treatment. In this way, the present laws and regulations requiring that drugs be proved safe and effective are circumvented. The situation encourages the consuming public to become its own medical counsel, a practice of questionable wisdom and acknowledged risk.

At least *some* of the drugs of natural origin that must, of legal necessity, be sold in this manner are safe and possess useful therapeutic properties. If this is true, why isn't an effort made to satisfy the appropriate federal requirements and to market these products in the normal manner? The answer lies in the economics of such efforts. A prospective pharmaceutic manufacturer or marketer must invest vast sums of money to conduct the tests needed to meet all of the requirements of a New Drug Application. Estimated costs of such exhaustive studies vary but figures as high as $100 million have been advanced for an individual drug. Because patent protection for the natural drugs is difficult, if not impossible, to obtain, organizations are not willing to make such an investment. This situation is also disappointing because many of the older plant drugs, if investigated by modern methodologies, might yield novel therapeutic agents of considerable utility.

But even more disappointing from the scientific, professional, and economic viewpoints is the quackery that has been fostered by permitting useless and sometimes even dangerous drugs to be sold by nonprofessionals to individuals who hope that their conditions, which are not alleviated by recognized drugs, will yield to folkloric treatments of unproven value. For this reason alone, although there are many others, the knowledgeable pharmacist of today must have a working knowledge of these questionable herbal and nutritional

Fig. 16-1. A variety of herbal products in a "health-food" store. (Photo courtesy of David Umberger.)

remedies. The pharmacist must be able to provide information as accurate as possible to patients who, through ignorance or desperation, may be tempted to utilize such products. One must be alert to the need and opportunity to refer a patient for more traditional contemporary health care when indicated, but it is equally important to maintain credibility and lines of communication by avoiding demeaning or categoric "turn-off" comments such as "that is old-fashioned" or "it is worthless."

"NATURAL" AND "ORGANIC"

Before considering these so-called remedies on an individual basis, brief mention must be made of the misuse of the terms "natural" and "organic" when applied especially to certain foods and vitamins touted by their purveyors as superior to those not so categorized. The pharmacy student, because of his understanding of biology and biochemistry, immediately recognizes that there is no difference between, for example, vitamin C obtained from natural biosynthetic processes in rose hips and vitamin C obtained by synthetic processes in the laboratory. Thus, the word "natural," when applied to such materials, identifies only a source and not necessarily a degree of superiority or inferiority. In addition, it usually indicates that the purchaser may expect to pay 2 to 3 times the regular price for items so labeled.

The term "organic," as commonly applied to "health foods," implies that the produce was grown under conditions utilizing only natural fertilizers, such as manure, and that no pesticides of any type were applied. Plants cannot differentiate whether nutrients, such as nitrogen or potassium, are derived from organic or inorganic sources, provided they are in a form the plant can assimilate. They respond in the same way to equivalent quantities of each. Certain pesticide residues may pose health hazards if present in sufficient concentrations, but most are removed by proper cleansing, and appropriate limits of safety have been established for the others, e.g., environmental contaminants. Besides, the typical purchaser has absolutely no way of knowing whether the "health-food" item purchased is "organic" and "natural" as labeled except for the recognition that the seller has probably charged a substantial premium for items so designated. Thus, when used in the ways just defined, such terms are meaningless.

SAFETY AND EFFICACY CONSIDERATIONS

One final topic remains to be considered regarding the kinds of plants and products discussed in this chapter. If many of these products have little or no therapeutic value, and if others are actually harmful if used excessively, why do people insist on using them and why are they willing to pay high prices for such commodities? It is apparent that, in many such instances, certain beneficial effects may actually result owing to the so-called placebo effect, a medication action that is independent of, or minimally related to, the specific effects of the procedure or drug employed. The placebo effect operates through a psychologic mechanism.

Studies have demonstrated that, depending on the condition treated, placebos are effective in about 35% of the patients to whom they are administered. The beneficial effects are most likely to be manifested when the desired end point of therapy is a change in behavior, a subjective sensation, or a response under endocrine or autonomic control. Because the majority of herbs and "health foods" are utilized with the hope of inducing such changes, e.g., to make one "feel better," it is obvious that the desired result will be attained with some frequency. Confidence is also a factor in achieving good response to therapy or medical manipulation, and the selection of plant materials is often based on a long family or ethnic tradition or on the recommendation of a respected friend or relative.

Use of the products does, however, present a number of hazards that must be made clear to any potential purchaser. Some of the products are definitely not safe for human use because they contain carcinogens or other toxic principles. Use of such self-selected nontherapeutic agents may prevent, or at least delay, the patient from seeking and obtaining needed medical treatment for a serious ailment. Because there are no applicable standards of quality, such products often do not consist, either partially or entirely, of the material specified on the label; they are, therefore, frequently misbranded. Even if properly identified from a qualitative viewpoint, they are usually not standardized with respect to the contained concentrations of active constituents. That is, the analytic data that are critical and necessary for informed dosage determination are lacking for plant materials marketed through herb stores. Finally, most of these products are relatively expensive, and their routine use may prove quite costly, without resulting in any appreciable benefit to the user. For all of these reasons, prudent persons generally wish to avoid the indiscriminate use of herbs and "health foods."

In the following list, a number of so-called herbs, teas, health foods, food supplements, nutritional products, and the like, are treated monographically. Each will be discussed, in the light of the most recent objective scientific evidence, from the standpoint of its known safety and efficacy as well as from its probable potential therapeutic utility. Many of the value judgments rendered on this basis will vary appreciably from those presented in literature devoted to the promotion of the use of such drugs and related products. One must recognize that there is some degree of rationale for historic or folkloric uses of many plant materials, but their use may have been superseded in medical practice by more potent or effective therapeutic agents.

HERBS AND "HEALTH FOODS"

Alfalfa

The dried leaves, flowering tops, and seeds of *Medicago sativa* Linné (Fam. Leguminosae), commonly known as **alfalfa** or **lucerne,** are said to have stimulating properties when employed in the form of a tea. Alfalfa has been reputed to relieve arthritic

conditions and to stimulate the appetite, thereby inducing an increase in weight. There is no reliable scientific evidence that alfalfa has any of these effects in human beings.

Studies have shown that monkeys fed quantities of alfalfa seeds or sprouts develop systemic lupus erythematosus (SLE). Further, reports have appeared noting that patients with clinically and serologically quiescent SLE have had the disease reactivated by ingesting alfalfa tablets prepared from the overground parts of the plant. It is believed that the L-canavanine contained in all parts of the plant, but especially in the seeds (1%), replaces arginine in vital metabolic processes in the body, thus causing recurrence of SLE. Patients suffering from this disease should avoid the consumption of alfalfa products.

Aloe

See pages 62–64 for a discussion of aloe and aloe vera gel.

Angelica

Both the dried fruit and the dried root of *Angelica archangelica* Linné (Fam. Umbelliferae) contain approximately 0.5% of a volatile oil, which accounts for their use as flavoring agents. **Angelica** also has a history of use for a wide variety of medical purposes, including employment as an aromatic stimulant, a bronchial tonic, a carminative, a diaphoretic, a diuretic, an emmenagogue, and a treatment for rheumatism. Any efficacy associated with such applications presumably would be related to the volatile oil fraction. No active constituent and no specific pharmacologic response have been documented for angelica, and the plant is believed to lack major therapeutic utility.

Angelica contains a number of furocoumarins of the psoralen type, including angelicin, bergapten, imperatorin, and xanthotoxin. Such compounds are phototoxic, mutagenic, and even carcinogenic. They present risks to human health of sufficient magnitude to prompt scientists to recommend that unnecessary exposure to them, either by ingestion or by contact, be avoided.

Apricot Pits

Kernels of varieties of *Prunus armeniaca* Linné (Fam. Rosaceae), commonly referred to as **apricot pits**, are sold in "health-food" stores throughout the United States as a source of laetrile or amygdalin, which exists to the extent of about 3%. Technically, laetrile and amygdalin are not synonymous; the former is supposedly (−) - mandelonitrile - β - glucuronoside. However, because the product now offered as an anticancer agent is primarily amygdalin, the 2 names can be used interchangeably.

Controversy of an emotional and political nature has raged in recent years regarding the effectiveness of laetrile in treating cancer patients, particularly those who are terminally ill. Its purported mechanism of action, a selective release of cyanide or a toxic cyanide-containing compound in the cancer cells without injury to other normal cells or tissues, has never been proved. The FDA banned laetrile from interstate commerce in 1971; however, a number of states have since declared that intrastate production and sale are legal.

In 1981, the results were published of an extensive study conducted by the National Cancer Institute in collaboration with 4 major U.S. medical centers. They found that laetrile (1) did not make cancer regress, (2) did not extend the lifespan of cancer patients, (3) did not improve cancer patients' symptoms, and (4) did not help cancer patients to gain weight or become more physically active. Laetrile and natural products containing it, such as apricot pits, were thus found to be an ineffective treatment for cancer.

Still, the use of laetrile continues to a limited extent, largely owing to the innate human desire to cure something that, at present, is incurable. Because of the federal

ban, pure amygdalin for drug purposes is not readily available in the United States. As a consequence, patients have turned to the acquisition and use of apricot kernels as a source of the drug. This is a dangerous practice for, in addition to the amygdalin, the pits contain emulsin, an enzyme that hydrolyzes the glycoside, releasing toxic cyanide as detailed on page 70. Deaths have been reported from the ingestion of apricot pits. Although the emulsin may be inactivated by heating, complete inactivation is always uncertain. Even if inactivation is accomplished, the user may not realize that other sources of emulsin, e.g., almonds, must be avoided. Further, evidence now obtained from small-animal experimentation indicates that amygdalin alone, without the action of exogenous β-glycosidases, causes cyanide toxicity.

Because the treatment is ineffective and carries considerable potential danger, the use of apricot pits as an anticancer drug must be considered irrational. Its use should be avoided.

Arnica

An alcoholic extract or tincture of **arnica,** the dried flowering heads of *Arnica montana* Linné and related *Arnica* species (Fam. Compositae), has been used widely as a counterirritant in the treatment of abrasions, bruises, and sprains. Small amounts of the extract have also been used to treat inflammation of the gums and as a gargle/mouthwash for sore throats. The plant material contains 2 sesquiterpenoid lactones, helenalin and dihydrohelenalin, as well as esters of these two compounds, all of which possess anti-inflammatory, analgesic, and antibiotic properties. Unfortunately, helenalin is also an allergen, producing contact dermatitis in sensitive individuals. Arnica extract can be toxic if ingested; unnecessary risks are associated with a continuation of the old European folkloric practice of using such a preparation internally for cardiac and circulatory purposes.

Asafetida

Asafetida or gum asafetida is the oleo-gum-resin obtained by incising the living rhizomes and roots of *Ferula assafoetida* Linné, *F. rubricaulis* Boissier, *F. foetida* (Bunge) Regel, and probably of other species of *Ferula* (Fam. Umbelliferae). *Assafoetida* is from the Latin *asa*, meaning gum, or from the Arabic *aza*, meaning healing. The Latin *foetida* refers to the ill-smelling, offensive odor of the drug. Asafetida is sometimes referred to as devil's dung.

The plants are perennial branching herbs that reach up to 3 meters in height and are indigenous to eastern Iran and western Afghanistan. A substance supposed to be asafetida has been used under the name of *Laser* in Iran and India since time immemorial. It appears in Sanskrit works under the name of *Hingu*. It has long been employed by the Arabs, who no doubt introduced it into Europe during the Middle Ages.

Asafetida occurs as a soft, sometimes almost semiliquid mass, as irregular masses of agglutinated tears, or as separate ovoid tears that range from 1 to 4 cm in diameter and which, when fresh, are tough, yellowish white, and translucent. These tears change in color gradually to pinkish, violet-streaked, and finally reddish brown. They are hard and brittle when dry. Internally, the tears are milky white and opaque, the odor is persistently alliaceous, and the taste is bitter, alliaceous, and acrid. Asafetida should be kept in tightly closed bottles.

The drug contains from 4 to nearly 20% of a volatile oil, 40 to 65% of resin, and about 25% of gum. The main constituent of the oil is isobutylpropanyl disulfide which is accompanied by a number of related organic disulfides. Some terpenes are apparently also present. The resin consists of asaresinotannol, both free and combined with ferulic acid. Umbelliferone is also present in combined form.

Asafetida has been used as a carminative, an expectorant, an antispasmodic, and a laxative.

Aveloz

Aveloz is a drug prepared from the latex of *Euphorbia heterodoxa* Müll. Arg. (Fam. Euphorbiaceae), a Brazilian shrub commonly known as killwart. It is said to have been applied locally as a wart or tumor remover, first by the Amazonian Indians and, subsequently, by the European settlers in southeastern Brazil. Now it is marketed in this country both as an ointment for external application and as a liquid for internal use, with the claim that it is effective in the treatment of cancer, tumors, cysts, warts, and fibromas.

About 90% of the species in the Euphorbiaceae yield a latex that is extremely irritating to the skin and mucous membranes. Their latex has been used in folk medicine since at least 400 B.C. as an escharotic to treat cancer, tumors, and warts. Although aveloz has apparently never been analyzed chemically, the latex of other *Euphorbia* species has been shown to contain diterpene esters with antileukemic activity. However, these same kinds of esters also act as tumor promoters, or cocarcinogens. Until detailed chemical and physiologic studies are carried out and the safety and efficacy of aveloz is definitely established, the medicinal use of this potent plant material can certainly not be recommended.

Black Cohosh

Black cohosh is the dried rhizome and roots of *Cimicifuga racemosa* (Linné) Nuttall (Fam. Ranunculaceae). The plant material has been used as an ingredient in bitter tonics to treat indigestion and loss of appetite, but its most common use has been related to its folkloric reputation for curing dysmenorrhea. It is also claimed to have value in treating bronchitis, coughs, and chronic rheumatism.

The drug contains 15 to 20% of resin, a bitter principle, saponins, and other glycosidic constituents, but knowledge of the chemical composition of black cohosh is incomplete. No pharmacologic evidence supports any therapeutic use of the plant material. Toxic reactions, including bradycardia, tremors, and vertigo, have followed ingestion of preparations that contain black cohosh. Prudence dictates that neither the drug nor preparations containing it should be consumed.

Blessed Thistle

Blessed thistle, the dried overground portion of *Cnicus benedictus* Linné (Fam. Compositae), contains cnicin, a bitter diterpenoid lactone. The plant material still finds limited use as a bitter tonic for appetite stimulation and for relief of flatulence and indigestion. It also has an old reputation for use in diseases of the liver and gallbladder, but no acceptable scientific evidence supports any therapeutic value for this plant.

Blue Vervain

Blue vervain or wild hyssop is the dried tops of *Verbena hastata* Linné (Fam. Verbenaceae). The bitter-tasting material has been used as a diaphoretic, emmenagogue, expectorant, tonic, and tranquilizer. It contains verbenalin, a glucoside with weak parasympathomimetic activity. The plant material is nauseating when ingested in quantity and lacks practical therapeutic utility.

Boneset

Use of the bitter-tasting dried leaves and flowering tops of *Eupatorium perfoliatum* Linné (Fam. Compositae) or **boneset** was introduced to settlers by the American Indians. The plant material was once considered a panacea. Most uses were related to the diaphoretic response obtained on ingestion of a cupful of an infusion or tea prepared from a small amount of the material (2 to 4 g). The plant also has a laxative action and is an emetic in high doses.

Boneset is currently considered to lack

therapeutic merit, and the discomfort associated with its ingestion obviates any use for nutritional purposes. The plant, although incompletely characterized chemically, is reported to contain eupatorin, a triterpenic saponin.

Borage

Borage or common borage consists of the leaves of *Borago officinalis* Linné (Fam. Boraginaceae), an annual herb native to the Mediterranean region. Because of their content of tannin and mucilage, its dried leaves have long been used in folk medicine for their astringent and demulcent properties. The fresh leaves have been valued for use in salads and as an ingredient in refreshing beverages.

Although much skepticism has been expressed regarding the therapeutic efficacy of borage, no reports of its toxicity have appeared in the literature until recently. Now, low concentrations of two pyrrolizidine alkaloids, lycopsamine and supinidine viridiflorate, of a potentially poisonous nature, have been identified in it. Until the degree of toxicity of these compounds can be proved or disproved with certainty, those concerned about their health should avoid the consumption of borage for any purpose.

Bran

Bran consists of the coarse outer coat or hull of the grain of wheat, *Triticum aestivum* Linné (Fam. Gramineae). Technically, it comprises the pericarp, the integuments, and the nucellus of the seed. The product is valued in human nutrition for its high content of dietary fiber, that is, the food ingested by a monogastric animal that reaches the large intestine virtually unchanged. One series of analyses revealed 26.7% of dietary fiber in bran; in comparison, canned baked beans had 7.27%, boiled carrots 3.70%, and whole peaches 2.28%. The average American's diet provides a total of 2 to 5 g of fiber per day.

There is considerable evidence of an epidemiologic, clinical, and experimental nature that suggests that various disorders of the gastrointestinal tract are linked to inadequate dietary fiber intake. These conditions range from constipation and diverticulitis to tumors of the colon and rectum, and they include such seemingly unrelated problems as cardiovascular and gallbladder diseases. The salubrious effects of sufficient amounts of bran or other sources of crude fiber in the diet are apparently due not only to its water-holding capacity but also to its ability to adsorb such compounds as bile acids. This ability, in turn, modifies cholesterol metabolism.

The therapeutic value of bran (crude fiber) seems obvious, at least in the treatment of certain gastrointestinal disorders, such as constipation, appendicitis, and hemorrhoids. It has also brought about recent modifications in the recommended treatment of such conditions as ulcerative colitis and colonic diverticulosis. Preventive aspects of high-fiber diets for gastrointestinal and cardiovascular disorders are more speculative.

Some authorities now recommend that bran or other appropriate foods be included in the diet in sufficient amounts to provide 10 g of dietary fiber daily. This would be supplied by 2 to 4 tablespoons of natural unprocessed bran or one-half cup of All-Bran® cereal.

Broom

The dried tops of *Cytisus scoparius* (Linné) Link (Fam. Leguminosae) are known as **broom** or **Scotch broom.** The plant contains up to 1.5% of sparteine as well as lesser quantities of cytisine and other alkaloids. Broom has a long history of use as a cardiac remedy, a cathartic, and a diuretic. The moldy, dried blossoms have recently gained a reputation as a hallucinogen when smoked.

Sparteine has been used therapeutically for its depressant action in cardiac arrhythmias and for its oxytocic effect. The therapeutic use of sparteine for cardiac irreg-

ularities ceased a number of years ago owing to the availability of better drugs. FDA approval for use of this alkaloid as an oxytocic was withdrawn in late 1978 because of an unfavorable benefit-to-risk ratio. Broom is not safe for self-medication.

Buchu

Buchu is the dried leaves of *Barosma betulina* (Thunberg) Bartling et Wendland, *B. crenulata* (Linné) Hooker, or *B. serratifolia* (Curtis) Willdenow (Fam. Rutaceae). The plant material contains diosmin, a flavonoid glycoside, and a volatile oil. Diosphenol, a phenolic ketone, is the principal constituent of the volatile oil (see page 125).

The plants are indigenous to South Africa, and their medicinal use was introduced into Europe early in the 19th century. Although buchu functions as a diuretic and as a weak urinary antiseptic, more effective drugs are indicated for most conditions requiring these properties.

Burdock

Burdock or lappa, the dried first-year root of *Arctium lappa* Linné (Fam. Compositae), lacks known physiologically active constituents, but it has had many uses in folk medicine. It has been used as a diuretic, diaphoretic, childbirth aid, and alterative for treatment of gout, rheumatism, and syphilitic disorders. Preparations of the root have also been used to stimulate hair growth and to treat chronic skin conditions, such as dandruff and psoriasis. No substantive evidence supports any of these historic uses. Burdock root currently enjoys some popularity as an herbal tea (Fig. 16–2).

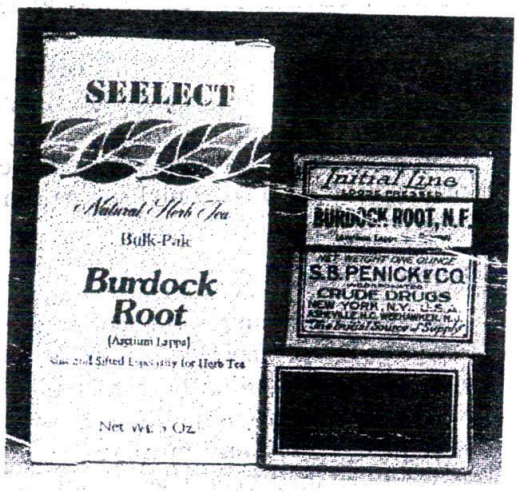


Fig. 16–2. Typical new (left) and old (right) packages of burdock root. (Photo courtesy of Kathy Delvecchio.)

Butcher's-Broom

The evergreen shrub *Ruscus aculeatus* Linné (Fam. Liliaceae), commonly known as **butcher's-broom** or **box holly,** is native throughout the Mediterranean region from the Azores to Iran. Its rhizome contains several steroidal glycosides, the aglycones of which, designated ruscogenin and neoruscogenin, are very similar chemically to diosgenin. Studies conducted in Europe have shown that these compounds possess anti-inflammatory and vasoconstrictive properties that are especially active on the venous system. Butcher's-broom is thus referred to as a phlebotherapeutic agent and is marketed in 2 forms: a capsule intended for internal consumption to treat circulatory problems in the legs and a rectal ointment for hemorrhoids.

Although available in the United States, usually from nondrug outlets, preparations containing this drug have not been proved safe and effective in this country. When they are labeled as possessing therapeutic utility for any condition, they are subject to confiscation.

Calamus

The pleasantly aromatic rhizome of *Acorus calamus* Linné (Fam. Araceae), used for centuries as a carminative and stomachic, is known as **calamus** or **sweet flag.** Calamus oil is widely used as a fragrance component in a variety of commercial products, ranging from soap to perfume. Although the exact composition of the volatile oil responsible for the plant's prop-

erties both as a drug and a fragrance is known to vary somewhat, one of its major constituents is ordinarily β-asarone.

Feeding studies in rats with the Jammu variety of calamus oil containing about 75% β-asarone produced growth depression, liver and heart abnormalities, and a serious effusion in the abdominal and peritoneal cavities of the animals. Malignant tumors were observed in the duodenal region after 59 weeks. All of these toxic effects were attributed to the β-asarone present in the oil. Consequently, calamus and its derivatives were prohibited from use in foods.

These findings stimulated extensive reinvestigation of the chemical composition of calamus oils from various sources with interesting results. Those obtained from triploid and, especially, tetraploid plants contained as much as 90% β-asarone. The oil of the diploid plant, *A. calamus* L. var. *americanus* (Rafinesque-Schmaltz) Wulff, was, on the other hand, essentially free of β-asarone. It has not yet been determined if the physiologic effects of the β-asarone–free oils are similar to the effects of those oils with high concentrations of that compound. If so, the employment of calamus obtained from such varieties provides an acceptable alternative to the complete discontinuance of use of this ancient remedy.

Canaigre

In recent years, certain herb marketers have attempted to promote the sale of **canaigre,** the root of *Rumex hymenosepalus* Torrey, by labeling it as "wild red American ginseng" or "wild red desert ginseng." This plant, a member of the family Polygonaceae and native to the arid regions of Texas and Mexico, bears no botanic relationship to ginseng, which is classified in the family Araliaceae. No evidence for the presence in canaigre of active panaxoside-like saponin glycosides, such as occur in ginseng, has ever been obtained. Instead, the root contains 30 to 45% tannins in addition to anthraquinones.

The medicinal uses of canaigre by Indians in the southwestern states and in Mexico relate to the root's astringent properties. They include topical use for skin irritations, treatment of sore throat, and prevention of diarrhea. No toxic, stress-relieving, or other adaptogenic properties of canaigre have been reported. Application of the name "ginseng" to canaigre is of recent origin.

As a result of an investigation conducted in 1978, the Herb Trade Association adopted a policy stating that any herb products consisting in whole or in part of *Rumex hymenosepalus* should not be labeled as containing ginseng. Although this action was directed toward solving a nomenclature problem and did not deal with the relative benefits or risks of using canaigre, it is important to note the carcinogenic potential of the plant owing to its high tannin content. Canaigre may be a useful material for tanning leather and dying wood, but at present, it has no established place in therapeutics.

Catnip

Catnip consists of the dried leaves and flowering tops of *Nepeta cataria* Linné (Fam. Labiatae), a perennial herb common in the United States. It was formerly an official drug in the *National Formulary* but was found lacking in significant therapeutic activity, excepting that of a mild aromatic, and was therefore deleted from that compendium.

A resurgence of interest in the herb occurred recently when it was reported that smoking catnip, either by itself or in combination with tobacco, induced a mild euphoria. Apparently, the psychedelic effects are so mild that users question whether they occur at all. One recent volume on drugs of abuse starts its discussion of catnip with the words, "Does it or doesn't it?" The book indicates that a debate has continued for many years as to whether one can actually get "high" by using the herb. Any drug whose mind-altering effects in

Fig. 16–3. Herbarium specimen of German chamomile (*Matricaria chamomilla*).

human beings are as questionable as those of catnip is scarcely worth considering for that purpose.

However, catnip has a considerable folkloric reputation as a sedative, and much anecdotal evidence supports the use of a cup of hot catnip tea at bedtime to ensure a good night's sleep. A major component (77 to 90%) of catnip volatile oil is *cis-trans*-nepetalactone, a compound structurally similar to the valepotriates, the sedative principles of valerian. This may account for the reported calmative hypnotic properties of this pleasantly aromatic herb.

Chamomile

The dried flower heads of *Matricaria chamomilla* Linné (Fam. Compositae) constitute the drug known as **German chamomile** or **matricaria** (Fig. 16–3). A related plant, *Anthemis nobilis* Linné, known as **Roman chamomile**, contains similar constituents and is similarly employed. Chamomile is extensively cultivated in Europe, where it is widely utilized in folk medicine for its carminative, spasmolytic, and anti-inflammatory effects. The most common form of the drug is a tea, but various extracts and volatile-oil–containing preparations are also available. In fact, chamomile is so highly regarded and so extensively used that it might be labeled the "ginseng" of Europe. Recently, chamomile has become one of the most popular herbal teas in the United States.

One group of persons should be especially cautious in utilizing chamomile. The tea, prepared from pollen-rich flower heads, has caused contact dermatitis, anaphylaxis, and other severe hypersensitivity reactions in individuals allergic to ragweeds, asters, chrysanthemums, and similar plants. In fact, persons allergic to any member of the family Compositae should avoid this as well as other teas prepared from composite flower heads.

As might be expected, such a renowned plant has been the subject of a large number of botanic, agronomic, chemical, and pharmacologic studies. In essence, the latter have revealed definite anti-inflammatory properties in chamomile, owing primarily to constituents of (or formed in) the volatile oil, especially chamazulene and (−)-α-bisabolol. Flavonoids and coumarin derivatives are, without doubt, responsible for most of the spasmolytic effects. Various other effects of the drug are probably caused by these and other undetermined constituents.

Unfortunately, an infusion (tea) contains only about 10 to 15% of the volatile oil present in the plant material, and the ingredients in the volatile oil provide most of the anti-inflammatory activity. Whole plant extracts or preparations containing quantities of the volatile oil are certainly much more effective. In spite of the relatively low concentrations of lipid-soluble active ingredients in the tea, one authority believes that,

when the tea is used over a long period of time, a cumulative beneficial effect may result. This belief is attested to by the centuries-old use of chamomile as a home remedy and healthful beverage in Europe and by its increasing popularity for these purposes among the laity in the United States.

Chaparral

Chaparral is a relatively ambiguous term that refers to a number of low shrubby plants growing wild in the arid regions of the southwestern United States and Mexico. As currently employed in "health-food" circles, the name designates the leaflets of *Larrea tridentata* (De Candolle) Coville (Fam. Zygophyllaceae), a plant more properly referred to by the common name, creosote bush. It is a strongly scented, olive-green bush that may attain a height of more than 3 meters. It grows from California to Texas and in Mexico.

The drug has been employed in the treatment of bronchitis and similar conditions related to the common cold. It is also said to be useful in the alleviation of rheumatic pain. Chaparral does not contain active principles known to be safe and effective in the treatment of either of these ailments. The leaflets do yield up to 20% of a resin that is an effective antioxidant because of the presence of an appreciable quantity of nordihydroguaiaretic acid (NDGA). This represents an amount of NDGA equivalent to approximately 5 to 10% of the dry weight of the leaflets.

NDGA is a very effective antioxidant, and concentrations as low as 0.01% are effective preservatives for animal fats. However, after studies showed that the compound produced cysts and kidney damage in rats, the FDA prohibited its use in products over which that agency exerts control. Because the U.S. Department of Agriculture exercises authority over the antioxidants added to lard and other animal shortenings, and it has not acted to prohibit the use of NDGA, the chemical is still employed as a preservative in such products.

Chicory

Chicory, the dried rhizome and roots of *Cichorium intybus* Linné (Fam. Compositae), is probably best known as an additive that enhances the bitterness, color, and body of coffee. It also has a history of use as a diuretic, laxative, and tonic and as a treatment of gallstones, hepatic disorders, and indigestion. Chicory contains the bitter sesquiterpenoid lactones, lactucin and lactucopikrin, as well as cichoriin (a coumarin glucoside), maltol (a simple pyrone), and taraxasterin (a triterpene).

The crude drug has no recognized therapeutic utility, but maltol, a constituent that also occurs in roasted malt and several other plant materials, has the potentially useful property of intensifying the sweetness of sugar.

Cholecystokinin (CCK)

The polypeptide hormone known as **cholecystokinin** or **CCK** is secreted by the duodenal mucosa. Long known to stimulate the flow of digestive fluids of the gallbladder and pancreas, it has more recently been shown to suppress appetite by acting on the satiety center of the brain. Such results were obtained when test animals were injected with the highly purified product. Nevertheless, nutritional entrepreneurs then began to market oral dosage forms of CCK, presumably obtained from bovine intestine, as anorectic agents. Capsules containing up to 1 g each of the hormone constitute the customary commercial product; they are usually available in non-drug outlets.

There is no evidence to support the contention that cholecystokinin has any significant anorectic activity when ingested orally. Because of its proteinaceous nature, it would be rapidly destroyed in the stomach before absorption could occur. In addition, there is considerable risk of its causing intestinal cramps, nausea, and vomiting. In view of its ineffectiveness as well as the side effects that accompany

orally administered CCK, such use of the product as an appetite suppressant cannot be considered safe, effective, or rational. The FDA has notified manufacturers and distributors of CCK to discontinue marketing it for this purpose. See page 271 for accepted diagnostic uses.

Cocillana

Cocillana is the dried bark of *Guarea rusbyi* (Britton) Rusby (Fam. Meliaceae). It is obtained from a tree indigenous to the Bolivian Andes where the bark is employed by natives for its cathartic and emetic properties. The plant material was used medicinally as a nauseating expectorant in some cough syrups, but the use of this ingredient has been discontinued.

Collinsonia

Collinsonia or stoneroot is the dried rhizome and roots of *Collinsonia canadensis* Linné (Fam. Labiatae). The plant material, which contains mucilage, resin, and tannin, has been used as an astringent, a diuretic, a diaphoretic, and a tonic. It is still used as an ingredient in a hemorrhoidal product, but the therapeutic merit of the plant material is questionable.

Coltsfoot

Farfara or coltsfoot may consist either of the dried flower heads or of the leaves of the plant *Tussilago farfara* Linné (Fam. Compositae). Curiously, the flowers develop first, and the broad leaves begin to appear only after the flowers have withered. Both parts of the plant contain large quantities of mucilage, which accounts for their popular use as demulcents and expectorants, particularly in the treatment of coughs.

Recent studies have shown that the young flowers of the plant are carcinogenic, producing a high incidence of hemangioendothelial sarcoma of the liver when fed to rats. The probable causative agents are 2 hepatotoxic pyrrolizidine alkaloids, senkirkine and tussilagine. These compounds have been detected in low concentrations in the flowers, young shoots, and leaves of the plant. The ingestion of any portion of the coltsfoot plant as an herbal remedy is highly inadvisable.

Fig. 16–4. New (left) and old (right) packages of comfrey. (Photo courtesy of Kathy Delvecchio.)

Comfrey

Symphytum officinale Linné (Fam. Boraginaceae) or **comfrey** is an ancient herbal remedy with a reputation as a cure for ulcerations of the external and internal organs following topical or systemic administration. The healing action of the rhizome, roots, and leaves has been attributed to their allantoin content, which ranges from 0.6 to 1% in the underground parts but exists only in traces in the leaves. At the present time, comfrey is one of the most common herbal teas sold to the American public (Fig. 16–4).

Unfortunately, at least some specimens of the plant also contain a number of pyrrolizidine alkaloids that are highly hepatotoxic. One of these alkaloids, lasiocarpine, has produced liver cancer in rodents fed diets containing only 50 ppm of the alkaloid. Additional studies incorporating 0.5% comfrey leaves in the feed of rodents produced malignant tumors of the liver and bladder. Based on these findings, the herb definitely cannot be recommended as a medicinal agent and, indeed, possesses considerable likelihood of causing harmful

effects in those utilizing it internally. In addition, deaths have been reported among amateur herb collectors who confused comfrey with digitalis *(Digitalis purpurea)* and mistakenly drank teas brewed from leaves of the latter species (see page 164).

Poor quality control procedures on the part of a major marketer of herbal teas resulted in a serious case of atropine poisoning in 1 consumer recently. It was subsequently determined that the product, presumably of eastern European origin, was contaminated with belladonna seed. This occurrence emphasizes the necessity of maintaining high standards of quality when dealing with vegetable drugs.

Cucurbita Seed

The seed of various *Cucurbita* species (Fam. Curcurbitaceae), especially that of *C. pepo* Linné (pumpkin and summer squash), *C. maxima* Duchesne (Hubbard, Turban, Marblehead, and Sibley squashes), and *C. moschata* Duchesne (crookneck and China squashes), has been widely employed as a relatively effective teniafuge. Ordinarily, a beverage prepared from at least 60 g of **cucurbita seed** is administered in divided doses; however, some authorities recommend a total dose of as much as 500 g.

An unusual amino acid, 3-amino-3-carboxypyrolidine (cucurbitin), found only in the seeds of certain *Cucurbita* species, is the active principle. The fact that a relatively high dose is required and the finding that the cucurbitin content is quite variable even within seeds of the same species probably explain certain literature reports of the lack of effectiveness of cucurbita seed as a teniafuge. Toxicity or other adverse side effects from this drug have apparently not been reported.

Damiana

Damiana consists of the leaves of the subtropical shrub *Turnera diffusa* Willdenow var. *aphrodisiaca* Urban (Fam. Turneraceae) native to the southern United States and Mexico. The drug is said to have been highly regarded as an aphrodisiac by Mexican Indians. At the turn of the century, various proprietary damiana preparations were marketed in the United States, but their physiologic activity was probably caused by their high ethanol content (usually 50%) or by the addition of other drugs, such as coca. One such preparation, Nyal's Compound Extract of Damiana, contained all of these ingredients plus nux vomica and phosphorus. Damiana was listed in the *National Formulary* until 1946.

Modern popular writers on drugs indicate that ingesting an infusion of damiana or alternatively smoking the leaves produces in the user a feeling of euphoria, characterized by relaxation and increased imagination. These reactions are said to be especially pronounced in women. It is stated that excessive use of the drug is deleterious to the liver. A damiana-containing cordial is produced in Mexico, but it is believed to contain too little of the drug to produce any physiologic effects.

Chemical studies of damiana have resulted in the isolation of 0.2 to 0.9% of a volatile oil, some of the constituents of which have been characterized, in addition to resin, tannins, gum, etc. The report of the presence of caffeine in the drug requires verification. No principle responsible for the purported activity of damiana as an aphrodisiac has been identified, nor have any scientific studies of the drug's physiologic effects been reported. A detailed study of the history of damiana has revealed that its purported aphrodisiac properties are nothing more than a hoax perpetrated by a drug firm in Washington, D.C., in 1874 in the expectation of selling a few bottles of a tincture of this exotic drug. There is no proper basis for the use of damiana by human beings.

Devil's Claw

The secondary storage roots of *Harpagophytum procumbens* De Candolle, a South African plant belonging to the family Pedaliaceae, are now widely sold in both Eu-

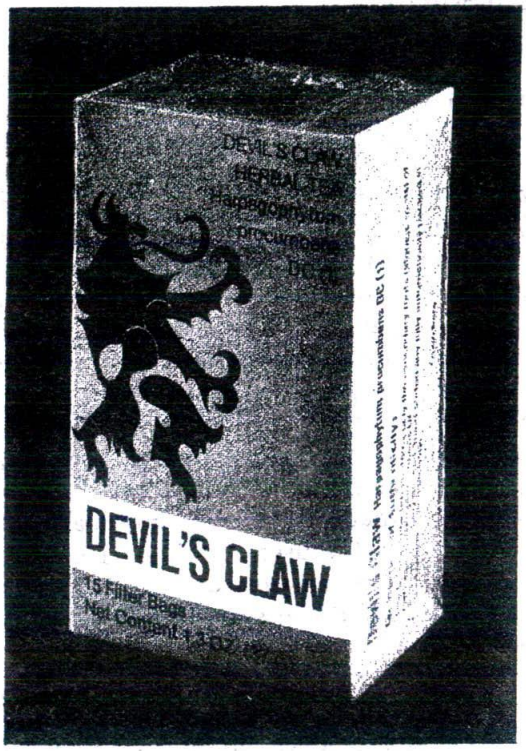


Fig. 16–5. A package of devil's claw tea bags.

rope and the United States under the name **Devil's Claw** (Fig. 16–5). An aqueous extract (infusion or decoction) is recommended in the treatment of a large number of conditions, particularly rheumatism. The anti-inflammatory effects of the drug have been attributed to 3 iridiod glycosides—harpagoside, harpagide, and procumbide.

Pharmacologic tests in small animals and clinical studies in human beings conducted in Europe have revealed that devil's claw does not exhibit any significant anti-inflammatory or analgesic activity. Extracts of it proved relatively safe when administered for short periods of time, but nothing is known about their long-term toxicity. It must be concluded that, aside from anecdotal evidence, there is little justification for the use of devil's claw in the treatment of any inflammatory syndrome.

The allegation that devil's claw possesses oxytocic properties requires verification. It apparently is based on a misinterpretation of statements by Watt and Breyer-Brandwijk that indicate that the drug is used by African natives to alleviate pain in pregnant women and especially in those anticipating a difficult delivery.

Echinacea

As used in the United States, the terms **echinacea, cone flower,** and **purple cone flower** refer to the dried rhizome and roots of *Echinacea angustifolia* De Candolle (*E. pallida* Nuttall). This plant is a perennial herb of the family Compositae and is native to the midwestern states. In Europe, the entire fresh, flowering plant is employed medicinally, as is another species, *E. purpurea* (Linné) Moench. Both species are said to have the same properties.

Echinacea was introduced into American medicine in 1885 by Dr. H.C.F. Meyer, who recommended it as a "blood purifier." He probably gained his knowledge of the plant from the early settlers and the Indians. Both groups valued it highly as a remedy against various types of infections, in treating bites of poisonous reptiles and insects, as a palliative agent in malignant conditions, and for its wound-healing properties. The drug continues to be used in this country as a folk medicine in the treatment of these same conditions, but particularly to increase resistance to infections. Echinacea is taken either in powdered form, as an infusion or decoction, or as an alcoholic tincture or extract. In Europe, it is used primarily in lotions and cosmetics for its wound-healing action, and, in injectable forms, to stimulate the body's immune system.

The bacteriostatic principle, echinacoside, a caffeic acid glycoside, has been isolated from the drug. Echinacea's wound-healing effects are attributed to a polysaccharide, echinacin B, which apparently forms a complex with hyaluronic acid that is resistant to attack by hyaluronidase. A hydrocarbon obtained from the root oil, (Z)-1,8-pentadecadiene, possesses in-vivo

antitumor activity. A polysaccharide fraction is apparently responsible for echinacea's ability to produce a nonspecific stimulation of the immune system, but only following injection, not after oral administration. However, neither these nor any of the other numerous constituents that have been identified in echinacea may be said to account for its folkloric reputation as a truly outstanding medicinal agent when taken orally. Further research is required to determine the therapeutic value of this drug and the chemical identity of its active constituents.

Eleuthero

Acanthopanax senticosus (Ruprecht et Maximowicz) Harms, also known as *Eleutherococcus senticosus* Maximowicz (Fam. Araliaceae), is a tall shrub native to eastern Siberia, Korea, and the Shansi and Hopei Provinces of China. It yields the drug known as **eleuthero** or **Siberian ginseng.** Apparently, eleuthero consists of the root of the plant, and most of the chemical studies have been devoted to that morphologic part, although the leaves, indeed the entire plant, may be employed. It is not always possible to determine which parts are actually used because the whole drug is not ordinarily an article of commerce; an extract is usually exported from the Soviet Union or from China.

Eleuthero, like ginseng, is a member of the family Araliaceae. It also contains a series of saponin glycosides, known in this case as eleutherosides, which accounts for its reputation as an adaptogen or antistress agent. The stimulant and tonic effects of eleuthero are said to be greater and longer acting than those of ginseng. This may, however, be related to the lesser variation in its concentration of active principles, at least in comparison to the extremely variable ginseng. One author believes that the enthusiasm shown for the drug in the Soviet Union is owing to its great abundance and ready availability there.

Because the commercial form of eleuthero is a powder (variously described as root or bark) that is either sold as such or as capsules, the extract is apparently mixed with a suitable diluent prior to marketing in the United States. The caveats expressed in the subsequent discussion of ginseng also apply to this drug. Lack of standardization, relatively high cost, the potentials of an abuse syndrome with such saponin-containing natural products, and unproven clinical effects in human beings all militate against the indiscriminate medicinal use of eleuthero.

Evening Primrose Oil

Seeds of the **evening primrose,** *Oenothera biennis* Linné, a stout, weedy, biennial plant of the family Onagraceae, contain between 15 and 20% of a fixed oil that consists, in part, of about 8% γ-linolenic acid. Advocates of the consumption of evening primrose oil note that γ-linolenic acid is a precursor of prostaglandin E_1, an adequate supply of which is purported to control hypertension and blood cholesterol levels and to prevent or relieve myocardial infarctions, rheumatoid arthritis, obesity, multiple sclerosis, eczema, acne, hyperactivity in children, premenstrual discomfort, alcoholism, and many other conditions.

One clinical study documenting the apparent effectiveness of evening primrose oil in treating atopic eczema in young adults has appeared, but in other studies, it was found to be ineffective for therapy for weight control, schizophrenia, and rheumatoid arthritis. A more recent investigation showed that patients with mastalgia showed significant clinical improvement when high doses (6 g per day) of the oil were administered. Evidence for its effectiveness in treating alcoholism and other conditions is either equivocal or completely lacking.

Evening primrose oil is currently marketed in the United States as a "dietary supplement" or "health food," not as a drug. This is apparently done to circum-

vent FDA regulations that require new drugs to be proved both safe and effective. As a result, there is an apparent lack of suitable quality control relating to both the tablets and the capsules (supposedly containing 500 mg of the oil) that are marketed at present. The oil is subject to oxidative decomposition; therefore, unless proper precautions are taken, tablets could not be expected to be a very stable dosage form. Some of the soft gelatin capsules labeled as containing evening primrose oil apparently have been filled merely with soy oil or safflower oil. In view of these stability and identity problems as well as the lack of proof regarding safety and efficacy of this drug, the best thing that can be said about it is, "Caveat emptor!"

Eyebright

Eyebright or the dried flowering tops of *Euphasia officinalis* Linné (Fam. Scrophulariaceae) has a popular reputation for use in various eye conditions, including black eyes, blepharitis, conjunctivitis, eye strain, and styes. It has also been used in the treatment of hay fever. The plant contains a tannin that could conceivably be beneficial, but the material is generally acknowledged as lacking therapeutic merit.

Fenugreek

Fenugreek consists of the dried ripe seeds of *Trigonella foenumgraecum* Linné (Fam. Leguminosae). The plant has hypoglycemic properties and, in addition, has been used as a demulcent, an emollient, and a treatment for indigestion. Originally, fenugreek was the principal ingredient, other than alcohol, in the well-known proprietary remedy, Lydia Pinkham's Vegetable Compound. Fenugreek contains trigonelline and a mucilaginous hydrocolloid. Although the seeds are not recognized as useful in the therapeutic control of hypoglycemia, they are employed as a flavoring agent in imitation maple syrup and as a poultice and an emollient in veterinary practice.

Feverfew

Ingestion of relatively small amounts (ca. 60 mg daily) of the fresh whole leaves or freeze-dried powdered leaves of *Chrysanthemum parthenium* (L.) Bernhardi, commonly known as **feverfew**, has been observed to provide some relief from the painful symptoms of migraine headache and arthritis. The antimigraine activity has been confirmed in preliminary clinical trials. However, neither the identity of the active principle(s) nor its mechanism of action has been established with certainty.

It is now postulated that certain sesquiterpene lactones present in feverfew may have a spasmolytic activity, thus rendering vascular smooth muscle less reactive to such compounds as serotonin. In other words, the active compound(s) might function in a manner similar to that of methysergide, a known serotonin antagonist. Long-term toxicity tests, activity-directed chemical fractionation and structure determinations, and additional clinical studies are needed to establish feverfew's safety and efficacy.

Fo-ti-tieng®

Fo-ti-tieng® is said to consist of a mixture of the leaves and stems of *Centella asiatica* (Linné) Urban var. *minor* (Fam. Umbelliferae), meadowsweet, and cola nut. Meadowsweet, in this instance, refers to the plant *Gillenia trifoliata* (Linné) Moench (Fam. Rosaceae), and cola (kola) is the dried cotyledon of *Cola nitida* (Ventenot) Schott et Endlicher (Fam. Sterculiaceae) or related species. Apparently, little kola is contained in the mixture, which consists mainly of a diminutive variety of the tropical plant that yields gotu kola *(q.v.)*. The name Fo-ti-tieng® is a registered trademark. It should not be confused with fo-ti, an entirely different drug derived from *Polygonum multiflorum* Thunberg (Fam. Polygonaceae).

Advocates maintain that the drug contains vitamin X, a principle alleged to exert

a marvelous rejuvenating effect on the brain cells and endocrine glands. Supposedly, the regular use of Fo-ti-tieng® permitted a Chinese herbalist to live 256 years, surviving 23 wives in the process.

The active constituents of Fo-ti-tieng® are probably identical to those of gotu kola. They confer some sedative, anti-inflammatory, and wound-healing activities on the drug. No scientific evidence supports the allegations that Fo-ti-tieng® promotes longevity, nor has its safety or efficacy been documented.

Garlic and Onion

An appreciable body of folklore and a much smaller amount of scientific evidence indicate that the ingestion of relatively large quantities of the bulbs of **garlic** (*Allium sativum* Linné) or of **onion** (*Allium cepa* Linné), both members of the family Liliaceae, results in a variety of physiologic effects, including stimulation of bile production, lowering of blood glucose and blood lipids, reduction of hypertension, acceleration of wound healing, and curing of the common cold. Recent controlled studies in human beings showed that those persons on a garlic- and onion-free vegetarian diet or on a diet involving the consumption of only small amounts of those foods (less than 10 g of garlic and 200 g of onion per week) had significantly higher serum triglycerides and *beta*-lipoproteins than those eating more than 600 g of onion and 50 g of garlic per week.

Chemical studies long ago revealed the presence of a potent antibacterial principle in garlic. This principle, designated allicin, was diallyldisulfide-S-oxide. Unfortunately, it is also the compound responsible for the characteristic odor of garlic, decomposing readily in the presence of air and water to yield diallyldisulfide and other similar odorous sulfides.

Recently, an antithrombotic factor was isolated from garlic. Designated ajoene, it was shown to form by the self-condensation of allicin. Studies indicate its mode of action involves inhibition of fibrinogen receptors on blood platelets.

Prostaglandin A_1, which has a hypotensive action on injection, has also been isolated from onions. This was the first reported occurrence of prostaglandins in higher plants and may facilitate our eventual understanding of the physiologic activity long attributed to this species.

Further chemical and pharmacologic research is needed to determine the real value of garlic and onion for the many conditions in which they are reputed to be effective. The isolation of a potent prostaglandin from onion and the results of recent preliminary clinical studies of onion extract on hypertension and hyperlipidemia further support the contention that both of these closely related species possess considerable potential value as therapeutic agents.

Gentian

Gentian or **gentian root** is the dried rhizome and roots of *Gentiana lutea* Linné (Fam. Gentianaceae), a plant indigenous to central and southern Europe and to Asia Minor. Commonly used as a medicine in the Middle Ages, gentian has been employed in modern times as a bitter tonic in anorexia and dyspepsia. Its current popularity in the United States is limited, but it is still widely used in Europe as an ingredient in alcoholic beverages valued for their stomachic properties.

High-quality gentian (yellowish brown to yellowish orange internal color) contains about 2% of gentiopicrin, a bitter glucoside. Slow drying of the root permits enzymatic hydrolysis of gentiopicrin and yields a darker reddish brown product that is inferior for use as a medicinal bitter.

Ginseng

Ginseng is the root of the perennial herbs *Panax quinquefolius* Linné and *Panax pseudoginseng* Wallich (*P. ginseng* C.A. Mey, *P. shinseng* Nees) (Fam. Araliaceae). The former grows in rich woods in the eastern

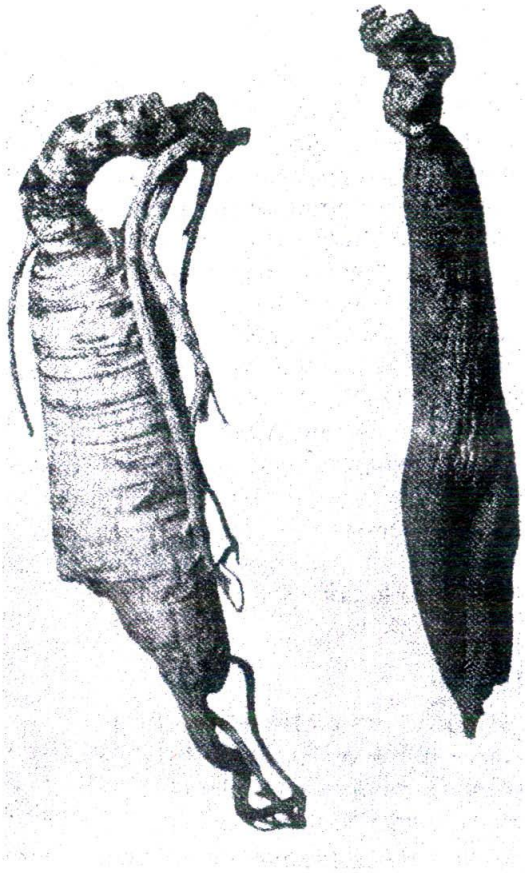


Fig. 16–6. Tuberous root of ginseng. The root on the left is a fresh specimen and was grown in the United States. The root on the right was purchased at a Chinese bazaar. It is translucent, yellowish brown, and has the characteristic shape and markings considered desirable by the Chinese. The markings on the upper segment of the specimen are stem-scars and are usually found on old roots. The translucent appearance is caused by the manner of treatment.

United States and Canada, and the latter is indigenous to the mountainous forests of eastern Asia. The roots are gathered from 3- and 6-year-old plants and carefully cleaned and dried (Fig. 16–6).

At present 3 kinds of ginseng are exported from the United States—wild root, cultivated root, and processed ginseng products. Last year the export of wild ginseng amounted to 43metric tons valued at $10.2 million ($107.84 per lb). Cultivated root exports were 71 metric tons with a value of $9.1 million ($57.96 per lb). Processed ginseng exports amounted to 152 metric tons valued at $13.8 million. The export value of ginseng root and products thus exceeded $33 million for a total of 266 metric tons in 1984. Most American ginseng is shipped to Hong Kong for subsequent distribution to other Oriental countries. In turn, the United States is a relatively large importer of ginseng, purchasing in excess of 125,000 lb per year from foreign sources. At present South Korea is the largest supplier. An additional 40,000 lb of domestic ginseng are utilized annually here in the United States.

American ginseng has been collected from wild plants and from cultivated stands and has been exported to China since the early 1700s. A ship sailed from Boston for China in 1773 with 55 tons of ginseng. The plant is now an endangered species in the United States. Its collection and sale are subject to registration, permits, reports, and an official ginseng season. Collector education is also mandatory. Cultivated ginseng is produced in Korea, Japan, the Soviet Union, and the United States, primarily in Wisconsin.

Ginseng contains a complex mixture of triterpenoid saponins. These glycosides have been categorized into 3 series—the panaxosides, the ginsenosides, and the chikusetsusaponins. One or more of these groups of glycosides appear to account for the biologic properties of ginseng.

Ginseng is a favorite remedy in Chinese medicine and is considered to have tonic, stimulant, diuretic, and carminative properties. It reportedly reduces the blood glucose concentration and acts favorably on metabolism, the central nervous system, and endocrine secretions. It is employed in the Orient in the treatment of anemia, diabetes, insomnia, neurasthenia, gastritis, and, especially, sexual impotence.

Recently, Western interest in the drug has vastly increased, and ginseng has become widely available in "health-food"

outlets. Indeed, it is estimated that, at present, 5 to 6 million people use the herb in the United States alone. Such widespread use has been accompanied by a veritable deluge of literature pertaining to the product and its purported activity.

Pharmacologically speaking, ginseng is classified as an adaptogen because some studies in animals suggest that it may help the body to adapt to stress and to correct adrenal and thyroid dysfunctions. Such effects, if real, are quite subtle but are apparently a function of the panaxoside saponin glycosides contained in the root. Ginseng is also heavily promoted as an aphrodisiac. The drug is administered in such forms as powders, extracts, and teas, usually in quantities ranging up to 15 g of root per day but averaging about 3 g.

Because of the relatively high cost of ginseng products and almost total lack of quality control in the "health-food" industry, studies recently performed have shown great variations in the panaxoside glycoside content of various preparations. Indeed, 60% of the products in one sampling were judged "worthless," and 25% of those sampled contained no ginseng whatsoever.

Perhaps even more disturbing, however, have been the results of some preliminary studies that seem to point to a definite ginseng-abuse syndrome in human beings utilizing the drug. Long-term use was associated with hypertension, nervousness, and sleeplessness in some subjects but had the opposite effects, hypotension and a tranquilizing effect, in others. These apparently contradictory findings may result from products containing different quantities of the various active glycosides.

Taken as a whole, the symptoms observed in ginseng abuse mimic those of corticosteroid poisoning, suggesting a steroid mechanism of action operating through the adrenal cortex or the pituitary gland. Although the effects are neither uniformly negative nor uniformly predictable, long-term ingestion of large amounts of ginseng should be avoided. In addition, the FDA found no evidence of enhanced sexual experience or potency resulting from its use.

Glucomannan

Glucomannan or Konjac mannan is a polysaccharide obtained from the tubers of *Amorphophallus rivieri* Durieu cv. konjac (Fam. Araceae), a perennial plant widely cultivated from Indonesia to Japan, where it is employed in the preparation of a foodstuff known as konjaku flour. Processing of konjaku flour by one of several methods yields glucomannan. It is composed of glucose and mannose units in a ratio of 1:1.6 connected by β-1,4 glucosidic linkages.

As is the case with most similar polysaccharides (see page 54 for galactomannan-containing gums), glucomannan swells when it comes in contact with water; it is said to expand to about 60 times its original volume when taken internally. This phenomenon has caused the product to be marketed as a diet aid, under the assumption that the increased bulk in the stomach would produce a feeling of satiety. Actually, glucomannan is a rather effective bulk laxative, but there is no convincing scientific or clinical evidence to document its use as an aid in weight reduction.

Glycyrrhiza

Glycyrrhiza or licorice (see page 68) has a long history of folkloric use for a wide variety of purposes. Some of these applications evolved into the medicinal use of licorice extracts in products for treating coughs and colds. Other uses are consistent with scientific evidence that suggests therapeutic potential in treating some inflammatory conditions and peptic ulcers, but many of the alleged benefits of this plant material as a cure-all have no basis in fact. Glycyrrhiza is distinct from anise and other anethole-containing plant materials that have a licoricelike flavor.

Goldenseal

Goldenseal is the dried rhizome and roots of *Hydrastis canadensis* Linné (Fam. Ranunculaceae). It has been used to soothe

inflamed eyes and mucous membranes and as a hemostatic in intestinal and uterine bleeding, a uterine stimulant, and a vasoconstrictor. The plant contains berberine and hydrastine; these alkaloids are astringents and have weak antibiotic properties (see page 212).

Medicinal uses of goldenseal have been discontinued in this country. Some heroin addicts undergoing treatment in methadone programs have claimed that goldenseal, used as an herbal tea, impairs the detection of morphine in the urine. Scientific studies have shown that this allegation is totally false. The plant material neither obscures the analysis of morphine nor facilitates urinary excretion of that alkaloid.

Gotu Kola

The leaves and stems of *Centella asiatica* (Linné) Urban (Fam. Umbelliferae) constitute the drug known as **gotu kola.** It is also referred to in the literature as **hydrocotyle** and **Indian pennywort.** Native to the warmer regions of both hemispheres, this slender, creeping plant is especially abundant in the swampy areas of India and Sri Lanka, in South Africa, and in the tropical regions of the New World. In addition to its use as a diuretic, as a "blood purifier," in promoting the healing of skin conditions, and in treating leprosy, gotu kola has been promoted as a body strengthener and revitalizer that can promote longevity. It is widely sold for this latter purpose.

Studies have shown that in high doses the drug has a definite sedative effect that resides in 2 saponin glycosides, brahmoside and brahminoside. Another glycoside, madecassoside, exhibits anti-inflammatory activity, and still another, asiaticoside, exerts a wound-healing action by stimulating mitosis. As yet, no evidence supports the use of gotu kola as a longevity promoter, nor does any substantive data exist on its safety or efficacy.

Common names often cause nomenclatural difficulties; the kola portion of the appellation gotu kola has caused some writers to confuse this drug with kolanuts, the dried cotyledon of *Cola nitida* (see page 245). The 2 drugs are not related. Caffeine, the active constituent of kolanuts, has not been identified in gotu kola.

Hawthorn

Dried flowers, fruits, leaves, and twigs of *Crataegus monogyna* Jacquin and related *Crataegus* species (Fam. Rosaceae) have been used in folk medicine since the Middle Ages. **Hawthorn** currently has no recognized medicinal application in the United States, but therapeutic use of an extract of the flowers or of powdered fruits has increased in Europe during the last 25 years. The plant product has a slow onset of action. It acts on cardiac or circulatory problems by causing dilation of blood vessels, especially the coronary arteries, and by causing some reduction in blood pressure; it is used prophylactically in angina pectoris. Claims of digitalislike or cardiotonic activity are apparently false. Toxicity from ingestion of hawthorn preparations is uncommon and is associated only with high doses.

Hawthorn contains neither cardiotonic glycosides nor alkaloids. It does contain a number of saponins, the aglycones of which are triterpenic acids, and it is rich in flavonoid glycosides. The flavonoid glycosides are thought to be the active constituents.

Anginia pectoris and hypertension are serious conditions not readily amenable to self-treatment. The use of hawthorn or any other drug for therapeutic treatment of such serious ailments should be undertaken only on the advice of a physician.

Hedge Hyssop

Hedge hyssop, the dried tops of *Gratiola officinalis* Linné (Fam. Scrophulariaceae), has a long history of use as a cathartic, diuretic, and emetic. Although it is still employed in folk medicine for treatment of chronic ailments of the liver and spleen, no scientific evidence supports its effective-

ness. The known constituents of the plant include betulinic acid, a triterpenic acid, and gratiolin, a triterpenic saponin.

Hibiscus

The dried, fleshy, ruby-red calyxes of *Hibiscus sabdariffa* Linné (Fam. Malvaceae) are boiled in water to prepare **hibiscus** or **Sudanese tea.** Relatively large concentrations of oxalic, malic, citric, tartaric, and hibiscic acid (the lactone of hydroxycitric acid) are present in the calyxes. They impart to the beverage a refreshing aromatic taste and a mild laxative action.

Honey

Honey or mel is a saccharine secretion deposited in the honeycomb by the bee, *Apis mellifera* Linné (Fam. Apidae). Dextrose and fructose, in equimolar quantities, are the major constituents of honey. Some sucrose, small quantities of other carbohydrates, volatile oils, pigments, and pollen grains are also present.

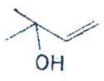
Honey is a useful nutrient and sweetener. Therapeutically, it has a long tradition of use as a demulcent in cough preparations, and many special claims for the virtues of honey are found in the records of folkloric remedies. No scientific evidence supports any of the special medical claims that are sometimes advanced for honey, including specific wildflower honeys. The demulcent and nutrient properties of honey are not significantly superior to those of less expensive carbohydrate products, such as liquid glucose (see page 32).

Hops

Hops or humulus consists of the dried strobile of *Humulus lupulus* Linné (Fam. Moraceae), which bear glandular hairs. These hairs, known as **lupulin,** contain most of the bitter principles that account for the use of the product in brewing and in medicine. The plant is a perennial herbaceous climber, extensively cultivated in England, Germany, various parts of the United States, South America, and Australia. Hops are collected in September when they are ripe, are carefully dried by means of artificial heat, and are packed into bales or bags.

The principal constituents of hops are contained in a volatile oil fraction (0.3 to 1%) and a resinous fraction (30%) which combine to produce the drug's characteristic taste and aroma. β-Myrcene (30 to 50%), humulene (15 to 25%), esters of myrcenol, linalool, and numerous other minor constituents constitute the volatile oil. Chemically unstable phloroglucinol derivatives, such as humulone and lupulone, are found in the resinous fraction. These latter components isomerize to produce principles whose bitter taste and bacteriostatic properties account for the use of hops in the brewing process.

Since the Middle Ages, when it was observed that hop pickers tired easily, the drug has been reputed to have a sedative effect. The constituent responsible for this activity has recently been identified as a volatile alcohol, 2-methyl-3-butene-2-ol. After drying of the hops, the concentration of this compound begins to increase, reaching a maximum of approximately 0.15% after 2 years at room temperature.



2-Methyl-3-butene-2-ol

Hop extracts are widely employed in OTC sedative preparations marketed in Europe. Hops are also marketed in "health-food" stores in the United States, not only for the preparation of a sedative tea but also as a legal intoxicant. Because the plant is rather closely related to marihuana, hops is said to produce a mild sensation of euphoria when smoked. This practice is definitely not recommended because prolonged use produces side effects, including dizziness, intoxication, and jaundice.

Horehound

Horehound is the dried leaves and flowering tops of *Marrubium vulgare* Linné

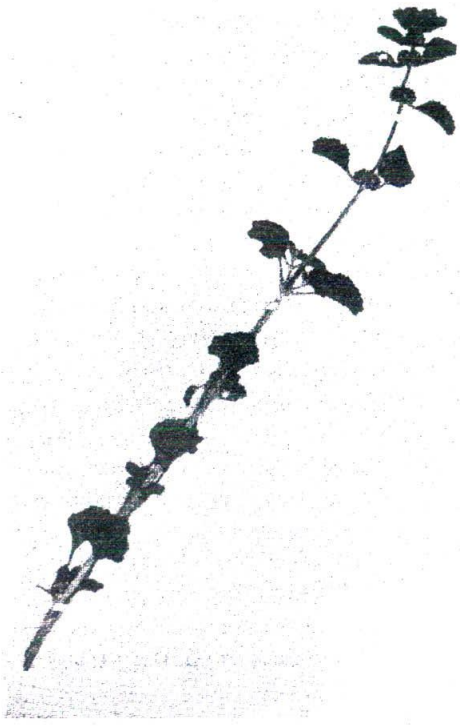


Fig. 16–7. Dried leaves and flowering top of horehound (*Marrubium vulgare*).

(Fam. Labiatae). The material has been widely used as an expectorant and flavoring agent in cough preparations. It is said to be the most popular of the herbal cough remedies. A volatile oil fraction and marrubiin, a hydroxyditerpenoid lactone bitter principle, contribute the distinctive taste to horehound preparations (Fig. 16–7).

Horse Chestnut

Horse chestnut consists of the seeds of *Aesculus hippocastanum* Linné (Fam. Hippocastanaceae), a tree reaching 30 m or more in height with a dense crown and white or reddish flowers. The glistening brown, more or less spherical seeds are about 2.5 to 3 cm in diameter. They contain approximately 3% of a mixture of saponins of the β-amyrin type known as aescin.

Various extracts of horse chestnut as well as purified and often chemically modified (solubilized) aescin preparations are widely marketed in Europe and are occasionally available in this country for their anti-inflammatory and antiexudative properties. Products intended for oral, parenteral, and local administration are utilized in the treatment of varicose veins, hemorrhoids, and the like. Physiologic tests in animals and clinical studies in human beings have obtained evidence supporting the value of horse chestnut in these conditions. Results indicate that aescin tends to normalize increased blood vessel wall permeability and to reduce edema in surrounding tissues. It also increases tonus of the veins, thereby facilitating return blood flow to the heart. None of the horse chestnut or aescin preparations has been approved for drug use in the United States.

An almost universal folk belief centers around the use of seeds of horse chestnut and related species, e.g., Ohio buckeye (*A. glabra* Willdenow), as a preventive or cure for arthritis and rheumatism. Simply carrying a seed in the pocket is supposed to ward off or cure such afflictions. Needless to say, there is no scientific basis for this ancient superstition.

Horsetail

Equisetium arvense Linné (Fam. Equisetaceae), commonly referred to as **horsetail,** is a rushlike perennial with hollow, jointed stems and scalelike leaves. The stems contain large amounts (5 to 8%) of silica and silicic acids, accounting for the use of the plant as a metal polisher and for its synonym, scouring rush.

Horsetail is characterized in modern herbals and other promotional literature as a valuable diuretic and astringent for the treatment of various kidney and bladder ailments. Capsules containing 500 mg of the plant material are available, usually in nondrug outlets. Actually, horsetail lacks any significant therapeutic utility. It is a very weak diuretic, and when such activity is required, much more effective and reliable drugs are available.

Hydrangea

The dried rhizome and roots of *Hydrangea arborescens* Linné (Fam. Saxifragaceae), an old Cherokee Indian remedy, has an extensive folkloric reputation as a diuretic and a treatment for kidney stones. **Hydrangea** is also said to have cathartic properties. Leaves of *H. paniculata* Siebold var. *grandiflora*, the hydrangea commonly cultivated in gardens, have been smoked to induce a kind of intoxication. They have also been recommended as a non-nutritive sweetener in hot beverages.

The plant contains, among other constituents, a cyanogenic glycoside that renders its consumption in any form unsafe and unwise. Vertigo and other toxic effects have been recorded following the use of hydrangea. There is no valid justification for its consumption.

Hyssop

Hyssop, the dried leaves and young tops of *Hyssopus officinale* Linné (Fam. Labiatae), is a volatile-oil-containing plant with a biblical record. The plant is used occasionally as a flavoring agent, and a decoction has been employed in folkloric medicine for a variety of purposes, such as catharsis, chronic catarrh, diseases of the chest, fevers, and rheumatism. A poultice of the decoction reputedly removes discoloration from black eyes. The volatile oil fraction of hyssop contains such constituents as cadinene, α-pinene, (−)-pinocampheol, and pinocamphone. No pharmacologically active constituent that might account for the plant's medicinal reputation has been identified.

Kelp

The term **kelp** is applied to a group of brown algae with large, flat, leaflike fronds that usually grow attached to rocks by means of a holdfast. They belong to the order Laminariales and include species of *Macrocystis* and *Nereocystis*, which are native to the Pacific coast, and *Laminaria*, which grows on the Atlantic coast of North America. The plants serve as a source of sodium alginate (see page 49).

Powdered kelp is employed in folk medicine primarily for its content of minerals, especially iodine. The concentration of iodine in kelp is extremely variable, depending on the species used, the age of the plants, and the time of harvest. It may range from less than 0.1% to more than 0.5% on a dry-weight basis. If a kelp preparation is to be useful, its iodine content should be standardized or at least determined and expressed on the label. Potassium is also present in kelp in relatively large amounts, but unfortunately, the sodium concentration is also high. Ingestion of kelp should consequently be avoided by those who must restrict their salt intake.

For many years, kelp has enjoyed a reputation as a useful agent in the control of obesity. Once again, this role is attributed to its iodine content, which, it is postulated, stimulates the production of the iodine-containing thyroid hormones (see page 255). This applies only when the person suffers from a deficiency of iodine, an unlikely event in this age of iodized salt. The RDA of iodine in adults does not exceed 150 μg. Because the ability of the thyroid gland to utilize iodine is limited, administration of moderate quantities beyond the saturation point has essentially no effect. Even if it were effective, the use of increased quantities of endogenous or exogenous thyroid hormones for weight reduction is not recommended.

Some persons claim that atherosclerosis is also amenable to treatment with the iodine-containing kelp. Those who recommend such treatment claim that kelp "cleanses" and "gives tone" to the walls of the blood vessels. Treatment of atherosclerosis with iodine is controversial and is not recommended. When iodine is used, precise doses, not available in the unstandardized kelp, are employed.

The use of kelp for any condition presents no advantages over conventional

therapy. In addition to all other problems associated with the product, kelp tastes bad.

Lecithin

Lecithin is a mixture of phosphatides that yield, on hydrolysis, α- or β-glycerophosphoric acid, fatty acids, and choline (see page 310). Although lecithin occurs in a variety of natural sources, including eggs, brain tissue, and many vegetable oils, the principal commercial source today is soybeans.

The daily ingestion of relatively large amounts of lecithin (10 g) is recommended by some "health-food" enthusiasts in the treatment of such conditions as gallstones, atherosclerosis, and various skin and nerve disorders. Such treatments are apparently based on the lipotropic properties of lecithin and on its utility, in vitro, as an emulsifying agent. Proof of its effectiveness, in vivo, for any of these conditions is either insubstantial or completely lacking.

Life Root

The dried plant of *Senecio aureus* Linné (Fam. Compositae) is known as **life root** or **golden ragwort.** This plant has been used medicinally, primarily as an emmenagogue, but it is considered without value in conventional medicine. Several toxic pyrrolizidine alkaloids, including senecionine, otosenine, florosenine, and floridanine, have been identified in life root. Although present in relatively small amounts, their carcinogenic nature renders the use of this drug inadvisable.

Linden Flowers

The flowers of several *Tilia* species (Fam. Tiliaceae) have been employed as a folkloric remedy for colds, headache, indigestion, and nervousness. **Linden flowers** contain flavonoid glycosides but are reportedly free of xanthine bases. Although the plant material has no substantiated medical utility, it is useful as a caffeine-free tea.

Lovage

Lovage, the dried rhizome and roots of *Levisticum officinale* Koch (Fam. Umbelliferae), contains several coumarins and up to 1% of a volatile oil. The plant material has been used as a mild stomachic, but its most common application is as a diuretic. Lovage is an example of the large number of volatile-oil-containing plants that are weak diuretics; the diuresis is caused by mild irritation of the renal tubules, which slightly retards the normally efficient resorption processes. Such herbs are not a replacement for more potent diuretics that are prescribed for cases of congestive heart failure and hypertension.

Marigold

Marigold is the dried ligulate florets of *Calendula officinalis* Linné (Fam. Compositae). It contains bitter principles, carotenoids, flavonoids, and a saponin. An infusion of the plant material has been applied locally as a vulnerary in chronic skin ulcers, contusions, cuts, hemorrhoids, sprains, and warts; it has also achieved some popularity as an aromatic bitter, a hair rinse, and a diaphoretic bath. The plant material has no current, recognized utility beyond its use as a weak aromatic tonic. Because pollen grains are present, the allergenic potential of marigold cannot be overlooked.

Mistletoe

The mistletoe family (Loranthaceae) consists of some 20 genera, but only 2 of them, the so-called American and European, are commonly encountered in the marketplace. Because of the similarity of their active constituents, these 2 types may be discussed together. Botanically, the common **American mistletoe** is *Phoradendron tomentosum* (De Candolle) Engelmann subspecies *macrophyllum* (Cockerell) Wiens. It is synonymous with *P. serotinum* (Rafinesque-Schmaltz) M.C. Johnston and *P. fla-*

vescens (Pursh) Nuttall. **European mistletoe** is *Viscum album* Linné, also a member of the family Loranthaceae. Three subspecies are commonly recognized: *album*, growing on broad-leaved trees; *abietis* (Wiesbaur) Abromeit, growing on *Abies alba;* and *austriacum* (Weisbaur) Vollmann, growing on various *Pinus* and *Picea* species.

Although the berries of both types of these parasitic shrubs have long been considered poisonous, the leaves, used in the form of a tea, have a considerable reputation as home remedies. Oddly enough, the 2 plants reputedly have somewhat opposite effects. American mistletoe is said to stimulate smooth muscles, causing a rise in blood pressure and an increase in uterine and intestinal contractions. European mistletoe has the reputation of reducing blood pressure and acting as an antispasmodic and calmative agent.

Scientific studies have now shown that the stems and leaves of both plants contain similar toxic proteins, designated phoratoxin, when isolated from *Phoradendron* species, and viscotoxins, when obtained from various subspecies of *Viscum album*. Both types are small basic proteins having the same molecular size (molecular weight approximately 5000) and the same number of amino acid residues (46). Six cystine residues occupy the same position in the chains. The biggest difference between phoratoxin and the viscotoxins is in the C-terminal part of the chain, where tryptophan and histidine appear in phoratoxin but not in the viscotoxins.

Contrary to the folkloric reputations of the respective plants containing them, phoratoxin and the viscotoxins produce similar physiologic effects when intravenously injected in mammals. These include hypotension, bradycardia, negative inotropic effect on the heart muscle, and vasoconstriction of vessels in skin and skeletal muscle. The LD_{50} of phoratoxin administered intraperitoneally to mice was 0.57 ± 0.05 mg per kg of body weight. It exhibited no antibiotic effect against bacteria or fungi. The effects of these toxins following oral administration in human beings remain uninvestigated.

Another hazard observed with certain Australian mistletoes (species of *Phrygilanthus, Dendrophthoe,* and *Amyema*) growing on oleander plants is the uptake by the parasite and the storage in its leaves of certain, potentially toxic, cardiac glycosides from the host. This activity also extends to mistletoes parasitizing other host plants containing extractable toxic constituents, such as certain solanaceous alkaloids in *Duboisia myoporoides* R. Brown. Thus, the identity of the host is of considerable significance in the case of mistletoes intended for medicinal use.

Mistletoe tea is widely recommended by many of the popular writers on herbs and "health foods" as a treatment for a variety of conditions ranging from anxiety to cancer. In fact, during the period of high coffee prices, some people promoted mistletoe as a pleasant common beverage. Results of the scientific investigations previously summarized emphasize the toxic nature of plant material derived from various types of mistletoe. The indiscriminate use of these products as home remedies should definitely be avoided.

Mormon Tea

Mormon tea consists of the stems and branches of *Ephedra nevadensis* Watson, (Fam. Gnetaceae), a small, erect shrub with divergent branches. This shrub occurs widely in the arid regions of the western and southwestern United States and in adjacent regions of Mexico. It is variously known as **Mexican tea, teamster's tea, squaw tea,** and, in Mexico, as **popotillo.**

Frontiersmen and Mexicans of the old West prepared a strong infusion (tea) from the plant, which was highly regarded in the treatment of syphilis and gonorrhea. The drink is quite astringent because of its high tannin content and has been regarded as a pleasant substitute for caffeine-containing ordinary tea and coffee. This latter

usage probably accounts for the name Mormon tea.

Unlike certain other medicinally used species of *Ephedra*, Mormon tea does not contain ephedrine. It does have a mild diuretic effect and is also slightly constipating, probably owing to the contained tannins. No therapeutic utility for Mormon tea has been established. Terry's statement concerning the drug is still as applicable today as when it was made more than 50 years ago. "Outside of its domestic use [as a pleasant beverage], very little may be said in its favor."

Muira Puama

Considerable confusion exists in the literature as to the botanic origin of **muira puama** or **potency wood**. It has been said to derive from *Liriosma ovata* Miers or *Acanthea virilis* (nom. nudum), but it is now believed to consist of the wood, stem bark, and root of 2 Brazilian shrubs of the family Oleacaceae, *Ptychopetalum olacoides* Bentham and *Ptychopetalum uncinatum* Anselmino. The drug has a long history of use in Brazilian folk medicine as a remedy for impotence.

Various "authorities" on herbs in this country recommend muira puama as an aphrodisiac and nerve tonic, indicating that the contained resin has a strong stimulating effect on the central nervous system. An aqueous decoction or alcoholic extract is administered internally, but the effect is also said to be obtained by bathing the genitals with a concentrated extract of the drug. The root bark is considered especially active.

Chemical studies have identified lupeol in the bark, but not in the wood, of *P. olacoides*. Lesser amounts appear in *P. uncinatum*. Campestrol and β-sitosterol have also been identified. None of these constituents accounts for the purported action of muira puama, nor have any controlled clinical studies been conducted to determine its efficacy. Until an active principle can be identified chemically or physiologically, the reputation of this drug must be viewed with considerable skepticism.

Oregano

Oregano or wild marjoram is the dried leaves and flowering tops of *Origanum vulgare* Linné (Fam. Labiatae). It is widely used as a culinary flavoring agent. The herbal literature lists many reputed uses of this plant material; the most common use involves the treatment of toothaches and oral inflammations. It is also recommended as a carminative, a diaphoretic, an emmenagogue, and a tonic, as well as for the relief of arthritic joints and nervous headaches.

The plant material contains a volatile oil whose most distinctive ingredient is carvacrol. This phenolic terpene may induce minor beneficial effects in some of the alleged health-related uses of the plant, but oregano has no significant therapeutic merit.

Pangamic Acid (Calcium Pangamate)

The exact composition of **pangamic acid** or **vitamin B_{15}** varies with the brand. One such product was found to be a mechanical mixture of 61.5% of calcium gluconate and 38.5% of dimethylglycine and was misrepresented as a single compound, the calcium salt of pangamic acid. It has been claimed to increase tissue respiration by the stimulation of glucose oxidation, particularly in the cardiac muscle, where it also is alleged to restore impaired metabolism in the myocardium, to dilate the venous blood vessels, and to exhibit a lipotropic function. Promoters therefore recommend it as a remedy for heart disease but also think it may be useful in treating blood abnormalities, asthma, emphysema, alcoholism, diabetes, and fatigue.

None of these activities has been scientifically proved. Pangamic acid is not recognized as essential in human nutrition and is, therefore, not a vitamin. Further, there is no evidence that pangamic acid is either safe or effective as a drug. In fact, dichloracetate, found as a component of

some pangamic products, has caused adverse reactions in diabetic patients, including mild sedation and increased serum uric acid levels. Based on present knowledge, pangamic acid must be considered as totally without merit.

Parsley

The leaf, root, and fruit of **parsley,** *Petroselinum crispum* (Miller) Nyman (Fam. Umbelliferae), have been used for centuries in folk medicine, primarily as diuretics and stomachics. The leaf of this common garden herb, cultivated throughout the world, is also widely employed as a culinary garnish. Although eaten infrequently, parsley is a rich, natural source of carotene, ascorbic acid, iron, and other minerals.

Medicinal use of the plant as a diuretic is based primarily on its volatile oil content, which varies from less than 0.1% in the root, to about 0.3% in the leaf, and to 2 to 7% in the fruit. Several chemical races of parsley are known; some yield oils rich (60 to 80%) in apiol. In other races, apiol is largely replaced by myristicin. Both apiol and myristicin are uterine stimulants, accounting for the use of parsley oil as an emmenagogue and its misuse as an abortifacient. There is no satisfactory evidence that it possesses any significant therapeutic value.

Passiflora

Use of the dried flowering and fruiting tops of *Passiflora incarnata* Linné (Fam. Passifloraceae), known as **passiflora** or **passion flower,** has a long history in folk medicine as a calmative agent for nervous unrest and as a sedative. The herb is usually administered in the form of a tea; an extract is also employed in a number of pharmaceutic specialty products marketed in Europe. The constituents responsible for its depressant effect remain unidentified, although harman has been isolated from the plant.

As of 1978, the FDA stated that it had not received valid scientific evidence to support the use of passion flower extract as a sedative or nighttime sleep-aid. Therefore, the FDA classified passiflora as a product that could not be generally recognized as safe or effective.

Páu d'Arco

Also known as **taheebo** or **ipe roxo, páu d'arco** consists of the inner bark of *Tabebuia impetiginosa* (Martius) Standley (Fam. Bignoniaceae) and probably other lowland species of *Tabebuia* as well. The inner bark of *Tecoma curialis* Soldanha da Gamma is also sometimes marketed as páu d'arco. All are more or less stately, broad-leaved trees native to the West Indies and Central and South America.

Reports from Brazil in the early 1960s praised a tea made from páu d'arco bark as an effective antineoplastic agent. Relatively little chemical work has been done on the bark, but it is believed that like the wood of *Tabebuia* species, it is rich (2 to 7%) in lapachol, a naphthoquinine derivative. Studies sponsored by the National Cancer Institute showed that lapachol was effective against various animal cancers, but trials with human patients produced toxic side effects at effective plasma levels of the drug. Extracts of páu d'arco itself showed only minor antitumor activity; it was concluded that the plant did not warrant further investigation.

Yet páu d'arco continues to be sold in nondrug outlets, often at a high price, as a "dietary supplement" but often with the implication that it is effective in the treatment of human cancer. Such implications are, of course, completely unsupported by any reliable scientific or clinical evidence.

Pennyroyal

The dried leaves and tops of *Hedeoma pulegioides* (Linné) Persoon (Fam. Labiatae) are known as **pennyroyal** or **American pennyroyal** (Fig. 16–8). The plant material was employed in a number of ways by the American Indians, including in the treatment of headaches. It has a long history of

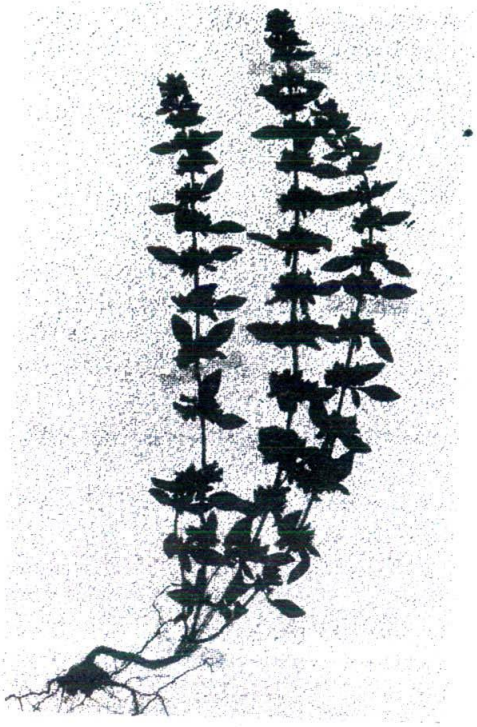


Fig. 16–8. American pennyroyal plant (*Hedeoma pulegioides*).

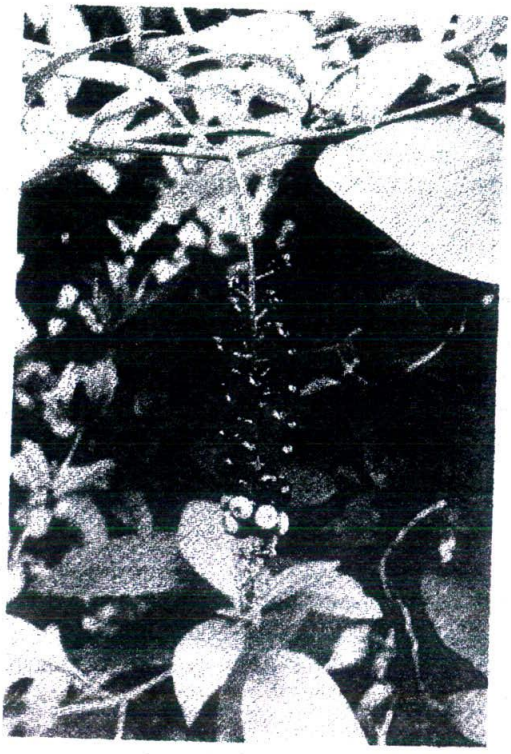


Fig. 16–9. *Phytolacca americana* (pokeweed, pokeberry) showing the leaves and fruits. (Photo courtesy of Dr. Thomas M. Zennie.)

medical use as an aromatic stimulant, a carminative, a diaphoretic, and an emmenagogue. The medical uses of the plant were presumably related to the contained volatile oil whose principal constituents include (−)-menthone, (+)-isomenthone, and pulegone.

Formal therapeutic use of the plant material and its volatile oil has been abandoned. No substantive evidence supports any claims for the use of pennyroyal as an emmenagogue or as a headache remedy.

Poke Root

Poke root is the dried root of *Phytolacca americana* Linné (Fam. Phytolaccaceae). It is a large, many-branched perennial herb that occurs abundantly in all parts of the United States and also grows spontaneously in southern Europe and northern Africa. The plant bears racemes of flowers that develop into clusters of dark purple, almost black, shining, compound berries (Fig. 16–9).

Various herbals promote the use of poke root for its emetic and cathartic properties, for the treatment of dyspepsia, and especially for chronic rheumatism. It is also claimed to be effective in a variety of conditions, ranging from dysmenorrhea to ringworm.

Actually, poke root is quite toxic; children have died and adults have been hospitalized from the gastroenteritis and diminished respiration induced by ingesting it or other parts of the plant. Extracts of poke are also mitogenic; therefore, the use of gloves is recommended when handling the plant. Employment of the young shoots as pot herbs, a widespread practice in some areas, is also not recommended.

The Herb Trade Association issued a policy statement in May 1979, declaring that

poke root should not be sold as an herbal beverage or food. It further recommended that all packages containing poke root carry an appropriate warning statement regarding the product's toxicity and its potential danger when taken internally.

Pollen

Pollen consists of the microspores of seed-bearing plants. The pollen available in "health-food" outlets in the form of tablets, capsules, extracts, and the like, consists of mixtures of the pollens of various entomophilous species. However, because collection techniques do not necessarily utilize the bee, this may not always be the case.

Promoted as a health food and general tonic, pollen contains small amounts of vitamins and minerals, as well as protein, carbohydrates, lipids, enzymes, and other constituents. Unfortunately, many pollens are highly allergenic when inhaled, and even entomophilous pollens may induce allergic responses when ingested. Because the product is potentially harmful and because its useful nutrients can be obtained more easily and more cheaply from other sources, its employment as a food supplement or a medicine cannot be recommended.

Propolis

Propolis or bee glue is a brownish resinous material collected by bees from the buds of various poplar and conifer trees and used by the insects to fill cracks or gaps in the hive. It is commercially available in the form of capsules, either as such or mixed half and half with bee pollen. The product is advertised as a natural antibiotic that can build body health and protect against harmful bacteria.

Some in-vitro evidence has been obtained to support the assertion that propolis possesses modest antibacterial and antifungal properties. However, the product was much less effective than standard drugs normally used for such conditions. Tentative claims for the potential therapeutic utility of propolis require clinical verification. It is of some utility in sealing openings in bee hives.

Red Bush Tea

Red bush or rooibos tea consists of the dried flowering twigs of *Aspalathus linearis* (Burman filius) R. Dahlgren (Syn.: *Borbonia pinifolia* Marloth) (Fam. Leguminosae). The plant is native to the mountainous regions of South Africa. It contains no xanthine bases and little tannin; therefore, the tea is claimed to be useful as a stomachic without adverse cardiac or gastrointestinal effects. One such product is marketed under the name Kaffree® Tea.

Rose Hips

Although fresh **rose hips**, the fruit of *Rosa canina* Linné (Fam. Rosaceae), contain concentrations of ascorbic acid ranging from 0.5 to 1.7%, the actual vitamin content of the commercially available, dried fruit is highly dependent on the exact botanic variety employed, its habitat, the climate where grown, time of collection, and method of drying. As a matter of fact, many of the marketed samples no longer contain detectable quantities of vitamin C.

Even if one assumes that commercial rose hips contain the relatively high ascorbic acid concentration of 1% and further assumes that all of the vitamin is extracted in preparing the tea, jam, soup, or other preparation that is to be ingested, the cost of vitamin C from this source would be about 25 times that of the synthetic product. Because neither of the mentioned assumptions is necessarily valid and because the natural vitamin is not intrinsically superior to the synthetic, rose hips are not an economical source of vitamin C. Commercial preparations, such as vitamin tablets that contain rose hips in combination with synthetic ascorbic acid, rarely state the proportion of vitamin derived from the natural source. In most cases, the proportion is probably insignificant.

Royal Jelly

The milky white, highly viscous secretion from the paired salivary glands of the worker honey bee, *Apis mellifera* Linné (Fam. Apidae), is known as **royal jelly.** It constitutes the sole food of all bee larvae for the first 3 days of life, and future queens continue to be nurtured with the product which is, in some way, responsible for their development into mature female insects.

Royal jelly contains proteins, lipids, fatty acids (including 10-hydroxy-Δ^2-decenoic acid and 9-oxo-Δ^2-decenoic acid), and vitamins of the B complex, especially pantothenic acid (100 μg per g of fresh material). Although various claims have been made for it, almost the only undisputed biologic action of royal jelly is in the differentiation of queen bees from workers. It is available commercially in almost all forms, including lotions, creams, soaps, capsules, and injections. A "hair restorer" containing royal jelly proved so popular in Hungary that fights broke out among the men waiting in line to purchase a bottle.

There is no scientific evidence that royal jelly affects the growth, longevity, or fertility of experimental animals. Likewise it does not exhibit estrogenic activity. Its use as a general tonic, to ward off the effects of old age, and to ease suffering from degenerative diseases, is without foundation.

Sarsaparilla

Sarsaparilla is the dried root of various *Smilax* species (Fam. Liliaceae). *S. aristolochiaefolia* Miller, *S. regelii* Killip et Morton, and *S. febrifuga* Kunth are known in commerce as Mexican, Honduran, and Ecuadorian sarsaparilla, respectively (Fig. 16–10). Sarsaparilla has been used as an alterative, an antirheumatic, a pectoral, and a tonic. It also has had a reputation as a "blood purifier" and as a specific for syphilis. Sarsaparilla is currently recognized as having potential value only as a flavoring agent and as a source of sarsasapogenin and smilagenin, steroidal aglycones with potential for use as precursors for the semisynthetic production of cortisone and other steroidal drugs (see page 174).

Sassafras

Sassafras albidum (Nuttall) Nees (Fam. Lauraceae), a small tree indigenous to eastern North America, yields a root bark known as **sassafras** or **sassafras bark,** which is widely used in the preparation of a tea employed as a spring tonic and "blood thinner." This is owing primarily to the 5 to 9% of highly aromatic oil contained in it, of which about 80% is safrole, a phenolic ether. Safrole has been recognized since the early 1960s as a carcinogenic agent in rats and mice. Both sassafras oil and safrole are presently prohibited by the FDA from use as flavors or food additives (Fig. 16–11).

Nevertheless, sassafras is still sold by "health-food" outlets, and writers of popular accounts of herbs continue to praise its virtues as an unexcelled home remedy. The town of Vernon in Jennings County, Indiana, even hosts an annual sassafras festival in the spring to publicize the aromatic root.

At present, it is estimated that a safrole dose of 0.66 mg per kg may prove hazardous to human beings. One cup of tea prepared from 2.5 g of sassafras could yield as much as 200 mg of safrole (equivalent to 3 mg per kg), depending on the exact method of preparation and the amount consumed. In spite of the drug's pleasant flavor and its folkloric reputation as a useful tonic, prudent people will avoid using sassafras because of its potentially harmful properties.

For those who wish to enjoy a somewhat modified flavor of sassafras without the health hazard, an extract from which the safrole has been removed is available on the market. Unfortunately, however, recent studies have shown that two thirds of the rats treated with a safrole-free ethanolic extract of sassafras produced tumors.

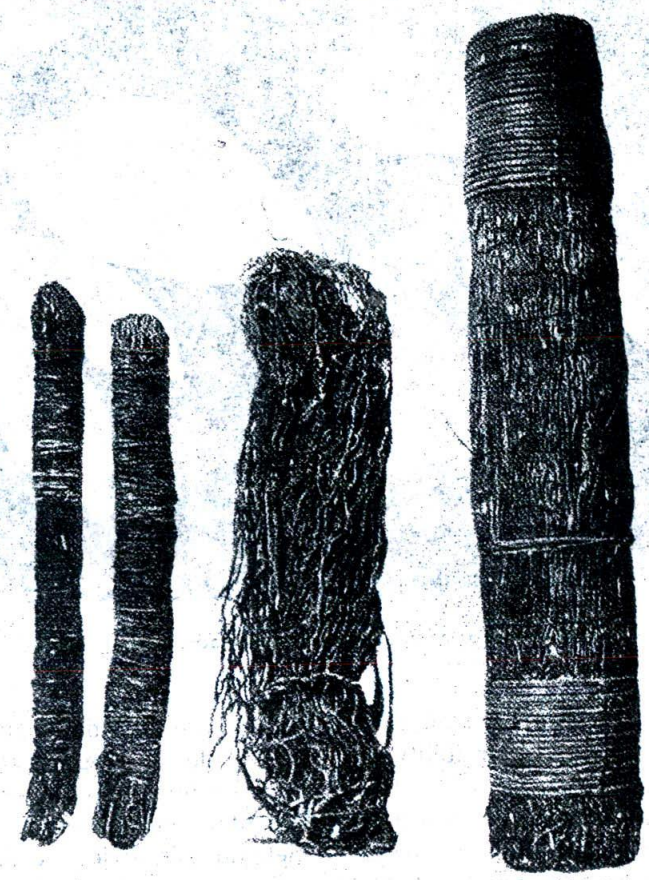


Fig. 16–10. Bundles of sarsaparilla. The 2 on the left are Honduran, the middle, Mexican, and the right, Paran, from a state in northern Brazil. (About ⅛ of natural size.)

Ingestion of sassafras in any form cannot be recommended.

Schisandra

The dried ripe fruit of *Schisandra chinensis* (Turczaninow) Baillon (Fam. Schisandraceae) constitutes the drug known as **schisandra** or **schizandra.** Obtained from a tree native to eastern Asia, the juicy, red berries, averaging 4 to 10 mm in diameter, gradually become brownish to black and shriveled on drying. They have a weak odor and an astringent, somewhat burning, taste.

Their ancient folkloric use in China was as an antiseptic, astringent, and tonic, but more recently they have been studied for their liver-protective effect. At present schisandra is marketed in this country as an adaptogen, an agent that increases bodily resistance to all forms of stress, including various disease states.

Limited pharmacologic studies of schisandra's properties have been carried out. An early study of schisandra extract revealed that it has a nicotinic effect on the ganglia, stimulating at low doses and blocking at higher doses. Some 30 lignans

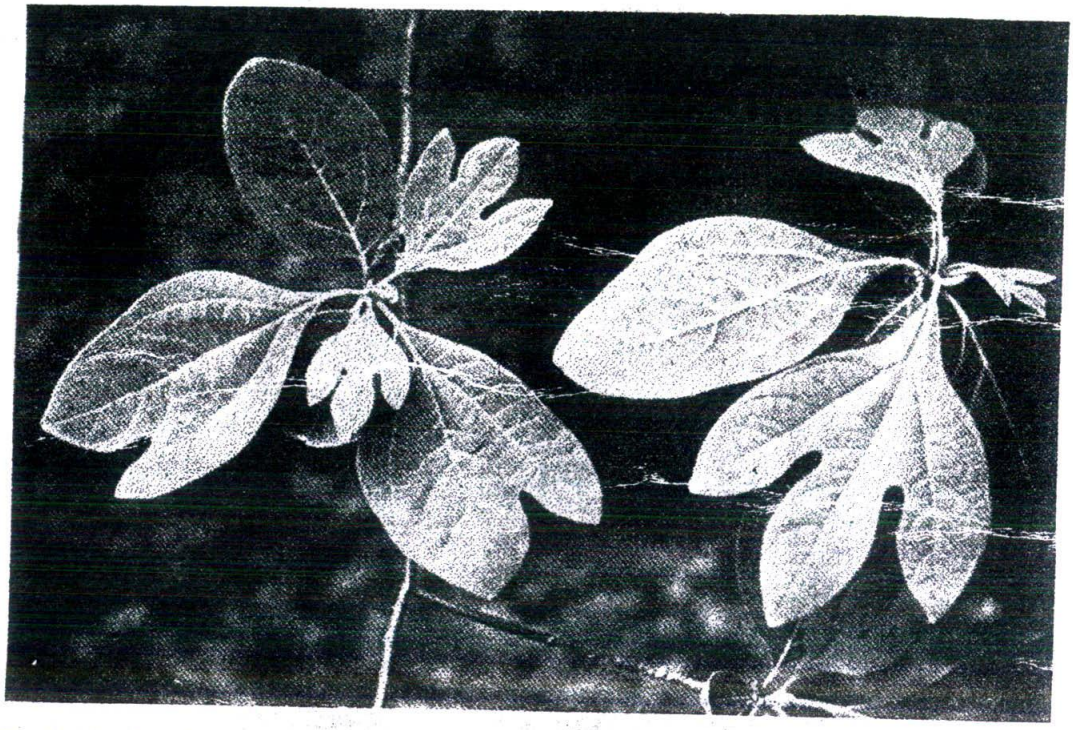


Fig. 16–11. Sassafras leaves showing considerable variation in shape.

have now been isolated from the fruit, and 22 of them were tested for their ability to reduce the cytotoxic effects of carbon tetrachloride and galactosamine on cultured rat liver cells. The results obtained were equivocal. Initial protective effects of the lignans were reduced at higher dosages, leading the investigators to conclude that schisandra lignans themselves may be toxic when administered in high doses over an extended period. Much more research needs to be carried out before schisandra can be considered safe, effective, and therapeutically useful for any condition.

Selenium

Trace quantities of **selenium** reputedly possess anticancer properties. An inverse correlation has been claimed between dietary intake of selenium and age-corrected mortalities from leukemia and from cancer of the breast, large intestine, lung, ovary, prostate, and rectum. Although traces of selenium are essential to animal health, no direct evidence supports any prophylactic benefit (reduction in cancer risk) from supplemental ingestion of the drug.

Selenium is toxic; the daily intake, including dietary sources, should not exceed 200 μg for the average adult. Use of selenium supplementation at this time is best left to controlled investigational situations.

Senega Snakeroot

Senega snakeroot is the dried root of *Polygala senega* Linné (Fam. Polygalaceae). The plant material containing triterpenic saponins has been used as an expectorant (approximately 1-g dose). Higher doses may cause vomiting and purging.

Senna

Senna or senna leaves, the leaflets of one or more *Cassia* species (see page 64), are readily available for use as an herbal tea. These leaflets contain dimeric anthrone glycosides, which are a potent laxative.

Ingestion of senna tea can result in diarrhea, dehydration, and related complications. Use of the tea presents unnecessary risks, and it should be avoided. If the laxative properties of senna are desired, an appropriately standardized OTC product with adequate dosing and precautionary labeling should be selected.

Spirulina

Spirulina is a blue-green alga ordinarily obtained from *Spirulina maxima* cultivated in Mexico or *S. platensis* grown in Thailand and California. These species, and possibly others, of the family Oscillatoriaceae, are harvested from fresh-water lakes in regions where bright sunlight favors their prolific growth and development. After rapid drying, the product is marketed, either as a powder or in the form of capsules or tablets customarily containing about 300 to 500 mg of plant material.

Advertised by promoters as a "super food" and a "safe diet pill," spirulina does contain 50 to 70% protein but, on a comparative weight basis, is inferior to more customary protein sources, such as eggs, milk, and beef. It also is at least 10 times as expensive as these products. Claims that spirulina facilitates weight loss have not been substantiated. In 1979, an FDA Advisory Panel found no reliable scientific data to demonstrate that it is safe and effective for use as an appetite suppressant.

Spirulina can be legally marketed as a food as long as it is correctly labeled and is not contaminated or adulterated. Some confiscations of imported product have occurred because of their contamination with rat hairs, bird feathers, and insects, particularly the ephedra fly. Studies have shown that the reported high concentrations of vitamin B_{12} in spirulina (0.25 to 1 μg per g) are, in fact, more than 80% vitamin B_{12} analogues, some of which may even be vitamin B_{12} antagonists. All of these problems associated with spirulina, coupled with its intense green color and bland taste, combine to make it a rather unattractive protein source lacking any obvious nutritional advantage or therapeutic utility.

Super Oxide Dismutase

Super oxide dismutase, commonly known as SOD, is a water-soluble metalloprotein (molecular weight approximately 32,000 daltons), usually obtained from the liver or red blood cells of the ox, *Bos taurus* Linné (Fam. Bovidae). It catalyzes the dismutation of the potentially cytotoxic superoxide radical (O_2^-, formed as a byproduct of tissue metabolism, to yield hydrogen peroxide and oxygen. SOD is thus thought to protect cell membranes against damage from reaction products associated with superoxide and hydroxyl radicals produced as a result of inflammation.

The drug is used to treat inflammatory conditions in veterinary practice, particularly in horses. It is administered by intramuscular or subcutaneous injection. However, promotional literature of the "health-food" industry has implied that oral administration of SOD is beneficial in the treatment of arthritis, providing protection from radiation, and in retarding the aging process. Tablets containing 2000 McCord/Fridovich units (125 μg) of SOD are commonly marketed for this purpose.

Analysis of 12 brands of SOD tablets purchased in "health-food" stores showed that 10 contained less than 20% of the labeled activity and 1 contained none. Further, there is no evidence that SOD appears in the blood following oral administration. Even if it did, the amount of SOD in the tablets is so minute that no therapeutic effects would result.

Tamarind

Tamarind is the partially dried ripe fruit of *Tamarindus indica* Linné (Fam. Leguminosae) that has been deprived of the outer layer of pericarp and preserved with sugar. The plant material is rich in citric and tartaric acids. It has a reputation of usefulness in treatment of dysentery and fevers. Tamarind (15 g) has been used medicinally as

a laxative, but it has been replaced for this purpose by other drugs.

Tarragon

Tarragon, the dried leaves and flowering tops of *Artemisia dracunculus* Linné (Fam. Compositae), is usually employed as a flavoring agent, especially in vinegar. It has been described as an aromatic bitter, a diaphoretic, an emmenagogue, and a mild sedative. The plant material contains a volatile oil and the coumarin derivatives, aesculetin dimethyl ether and herniarin. The therapeutic need for an aromatic bitter is questionable, and no scientific evidence supports the other medicinal uses of tarragon.

Tienchi

Tienchi, also known as **tienchi-ginseng** and **sanchi,** is the root of *Panax notoginseng* (Burkholder) F.H. Chen (Fam. Araliaceae), a perennial shrub cultivated in the Yunnan and Kwangsi regions of China. It contains the same type of saponin glycosides found in ginseng, and its physiologic activity and use are comparable to that drug. A number of tienchi products, including whole and powdered root, are currently marketed.

Tonka Beans

The principal source of **tonka beans** is *Dipteryx odorata* (Aublet) Willdenow (Fam. Leguminosae), a tree growing in the tropics of South America. Oblong-ovoid and somewhat flattened in shape, the 3- to 4-cm-long seeds or beans are nearly black, but their surface is usually covered with white crystals of coumarin, which they contain in concentrations as high as 10%. As a result, the beans are highly aromatic and were once valued as a flavor. However, in 1954, the FDA prohibited the use of coumarin and, consequently, of tonka beans for this purpose because of the compound's hepatotoxic properties. In addition, the product has been implicated in the induction of hemorrhagic diathesis in human beings.

Tonka beans are often sold in "health-food" stores and used in various teas for their "tonic" properties. They are also a frequent ingredient in vanilla extracts manufactured in Mexico and sold there to unsuspecting tourists. Because of their potential for producing liver toxicity and abnormal bleeding, tonka beans and any preparations likely to contain them should definitely be avoided by consumers.

L-Tryptophan

The time-honored method of inducing sleep by drinking a glass of warm milk at bedtime has gained some credence in recent years as a result of clinical studies indicating that administration of **L-tryptophan** in a dose of 1 g reduced sleep latency (time taken to fall asleep) in both normal human beings and in mild insomniacs. Doses higher than 1 g did not produce any increased effects. "Health-food" outlets, quick to recognize a potential article of commerce, promptly marketed 500-mg tablets of the amino acid at relatively high prices.

Advocates of the treatment have pointed out that most persons ingest from 0.5 to 2 g of L-tryptophan in their normal daily diet, so it can be thought of as a food substance rather than as a drug. This position is somewhat questionable because the probable mechanism of action of the relatively high single dose of the pure amino acid is an increase of serotonin in the serotonergic neurons of the brain. No safety studies have been conducted. In view of the lack of such information, L-tryptophan may be regarded as a potentially useful drug in sleep-onset insomnia, but its use certainly cannot be recommended.

Turmeric

Turmeric or curcuma is the prepared rhizome of *Curcuma longa* Linné (Fam. Zingiberaceae). The fresh plant material is treated by scalding or boiling prior to drying. Used primarily as a coloring agent and condiment in curry powders, prepared

mustards, and pickles, turmeric has also been employed to stimulate biliary secretions and to treat gallstones. The plant material contains bitter principles, curcumin (a yellow pigment), and a volatile oil. Curcumin has some broad-spectrum antimicrobial activity, but turmeric lacks recognized therapeutic utility.

Uva Ursi

Leaves of **uva ursi** (see page 77) are readily available in the form of herbal teas. The plant material is a diuretic and a weak urinary antiseptic, but more effective drugs than uva ursi are known for most conditions requiring these properties.

Valerian

Valerian consists of the dried rhizome and roots of *Valeriana officinalis* Linné (Fam. Valerianaceae), although other species of the genus, such as *V. mexicana* De Candolle, also contain active constituents (Fig. 16–12). The drug has been employed as a calmative in nervousness and hysteria for at least 1000 years.

Recent chemical studies of valerian resulted in the isolation of a series of water-insoluble, acid- and alkali-labile active constituents, collectively designated as valepotriates. These principles possess mild but definite tranquilizing activity in mice, cats, and human beings. Such effects are not synergistic with those of alcohol and barbiturates. This fact is particularly significant in view of the problems often encountered with these agents and the synthetic tranquilizers.

A large number of valerian products, often in combination with other sedatives of plant origin, are produced, marketed, and widely utilized in Europe. Valerian tincture is available in the United States, as is the powdered crude drug that is often administered in sweetened water. No official evaluation of the safety and efficacy of valerian has been made in this country, but its long and continued widespread use abroad seems to proclaim its utility.

Fig. 16–12. Roots and rhizomes of valerian with packages of the drug in capsules and in powdered form. (Photo courtesy of Kathy Delvecchio.)

Wild Lettuce

The dried milky juice of **wild lettuce,** *Lactuca virosa* Linné (Fam. Compositae), and of several other species of *Lactuca*, has been thought to possess soporific properties since remote antiquity. This belief was probably based on the similarity between the white milky juice exuded when the plant is incised and that yielded by the opium poppy. Claims for the presence of active principles, such as morphine or hyoscyamine, were made during the last century but were never verified. Wild lettuce ceased to be employed in conventional medicine in the 1920s.

Interest in the product was revived during the past decade when experimenters, searching the literature for legal intoxicants, encountered some uncritical statements concerning its purported physiologic activity. The placebo effect and a considerable amount of wishful thinking prompted various authors of drug-abuse books to advocate the smoking of wild lettuce. Fulton has provided a more accurate estimate of the lack of virtues of the drug, "Modern medicine considers its sleep-producing qualities a superstition, its therapeutic action doubtful or nil."

Wormwood

Wormwood, the dried leaves and flowering tops of *Artemisia absinthium* Linné (Fam. Compositae), has a history of use as an aromatic bitter for flatulence and indigestion, as a diaphoretic, and as a flavoring agent in alcoholic beverages, in which it allegedly produced a "narcotic" action for relief of general weakness. The plant material is not a narcotic pharmacologically, and its volatile oil is no longer a flavoring component in absinthe liqueur.

The plant material contains approximately 0.5% of a volatile oil with bitter substances such as absinthin, a diterpenic lactone that is an azulene derivative. The volatile oil is composed of (+)-thujone, thujyl alcohol, esters of thujyl alcohol, and other terpenoid compounds (see page 125).

The volatile oil has been associated with both acute and chronic toxicity, owing in significant part to its thujone content. The toxic response may be characterized by trembling, stupor, and convulsions; dementia or even death may occur. However, wormwood has long been known to induce mental impairment in humans in doses much lower than those required to produce outright toxicity. It is believed that such psychotomimetic effects result from the interaction of thujone with the same receptor sites in the brain as those that interact with tetrahydrocannabinol (THC). This theory requires verification, but it does explain the profound mental and physical changes in habitual and even casual users of absinthe, a wormwood liquor.

Legal restrictions in most countries now prohibit the use of wormwood or wormwood oil in preparations intended for human consumption. The plant material must be considered hazardous and should not be consumed.

Yarrow

The flowering tops of *Achillea millefolium* Linné (Fam. Compositae), a perennial herb common in both the United States and Europe, constitute the drug **yarrow** or **milfoil.** Both flowers and leaves contain an aromatic volatile oil which, like that of chamomile, is blue in color owing to the presence of chamazulene. This also accounts for the use of yarrow, usually in the form of a tea, for the same purposes as chamomile. Other bitter and astringent principles are also present in the plant.

Most of the statements made about the properties and application of chamomile also apply to yarrow. Persons who are allergic to any member of the family Compositae should be cautioned about its use.

Yohimbe

Yohimbe is the dried bark of *Pausinystalia yohimbe* (K. Schumann) Pierre (Fam.

Rubiaceae) a tree native to some of the tropical areas of west Africa. The bark contains up to 6.1% of a mixture of alkaloids, principally yohimbine.

Both yohimbe and yohimbine have been employed in folk medicine as aphrodisiacs. Shavings of the inner bark are boiled in water for one-half hour to yield a decoction that is drunk. Yohimbine hydrochloride is available as a prescription drug in a variety of solid dosage forms, often in admixture with such drugs as strychnine, thyroid, and/or methyltestosterone. Some authors recommend sniffing the drug to achieve both stimulant and mild hallucinogenic effects.

The drug dilates the peripheral blood vessels and lowers blood pressure. Alleged aphrodisiacal effects are attributed to the enlargement of blood vessels in the sexual organs and increased reflex excitability in the sacral region of the spinal cord. Yohimbe is a monoamine oxidase inhibitor, and appropriate dietary and drug restrictions should be observed when it is administered. Its use is contraindicated for persons suffering from hypotension, from diabetes, or from heart, liver, or kidney disease.

Yucca

The dried leaves of 1 or more of the 40-odd species of *Yucca* (Fam. Agavaceae) occurring in the southern part of North America constitute the drug known as yucca. Rich in steroidal saponins, the product was introduced into medicine in 1975, when the results of a single clinical study were published proclaiming yucca saponin extract as a safe and effective treatment for various forms of arthritis. Subsequent critical analysis of the study revealed a number of serious deficiencies, but it stimulated widespread use of yucca among hopeful arthritis sufferers, and that use continues.

According to a statement issued by the Arthritis Foundation, there is no proper scientific evidence that yucca tablets are useful in treating rheumatoid arthritis or osteoarthritis. They are probably harmless in themselves, but the real danger is substituting them for proven treatment procedures, thus leading to irreversible joint damage and possible permanent disabilities.

READING REFERENCES

To avoid confusion, reading references are divided into 2 groups:

1. Authoritative literature, which presents information on these products generally deemed factual by the scientific community.

2. Advocacy literature, which consists of modern herbal writings listing these materials and describing their uses in a largely uncritical fashion. These works are so numerous that only a limited sampling can be included here.

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