Native Medicinal Plants

TRADITIONAL NATIVE HERBAL REMEDIES

ASTHMA
Skunk Cabbage.Used by the Winnebago and Dakota tribes to stimulate the removal of phlegm in asthma. The rootstock was official in the U.S. Pharmacopoeia from 1820 to 1882 when it was used in respiratory and nervous disorders and in rheumatism and dropsy. Mullein.Introduced by Europeans. The Menominees smoked the pulverized, dried root for respiratory complaints while the Forest Potawatomis, the Mohegans, and the Penobscots smoked the dried leaves to relieve asthma. The Catawba Indians used a sweetened syrup from the boiled root, which they gave to their children for coughs.

BACKACHE
Arnica.
Gentian.
The Catawba Indians steeped the roots in hot water and applied the hot fluid on aching backs.
Horsemint.
The Catawba tribe crushed and steeped fresh horsemint leaves in cold water and drank the infusion to allay back pain. Other tribes used horsemint for fever, inflammation, and chills.

BRONCHITIS
Creosote Bush.
A tea of the leaves was used for bronchial and other respiratory problems.
Pleurisy Root.
The Natchez drank a tea of the boiled roots as a remedy for pneumonia and was later used to promote the expulsion of phlegm,
Wormwood.
The Yokia Indians of Mendocino County used a tea of the boiled leaves of a local species of wormwood to cure bronchitis.

BURNS
Yellow-Spined Thistle.
The Kiowa Indians boiled yellow-spined thistle blossoms and applied the resulting liquid to burns and skin sores.

CHILDBIRTH
To Speed Childbirth:
Partridgeberry.

The Cherokee used a tea of the boiled leaves. Frequent doses of the tea were taken in the few weeks preceding the expected date of delivery.
Blue Cohosh.
To promote a rapid delivery, an infusion of the root in warm water was drunk as a tea for several weeks prior to the expected delivery date. To Speed Delivery of the Placenta:

American Licorice.
A tea was made from the boiled roots.
Broom Snakeweed.
Navajo women drank a tea of the whole plant to promote the expulsion of the placenta.
To Stop Post-Partum Hemorrhage:

Buckwheat.
Hopi women were given an infusion of the entire buckwheat plant to stop bleeding.
Black Western Chokecherry.
Arikara women were given a drink of the berry juice to stop bleeding.
Smooth Upland Sumac.
The Omahas boiled the smooth upland sumac fruits and applied the liquid as an external wash to stop bleeding.
To relieve the Pain of Childbirth:

Wild Black Cherry.
Cherokee women were given a tea of the inner bark to relieve pain in the early stages.
Cotton.
The Alabama and Koasati tribes made a tea of the roots of the plant to relieve the pains of labor.

COLDS
Boneset.
Boneset tea was one of the most frequently used home remedies during the last century. The Menominees used it to reduce fever; the Alabamas, to relive stomachache; the Creeks, for body pain; the Iroquois and the Mohegans, for fever and colds.

COLIC
Catnip.
The Mohegans made a tea of catnip leaves for infant colic

CONTRACEPTIVES
Ragleaf Bahia.
The Navajos, who called the Ragleaf bahia herb twisted medicine, drank a tea of the roots boiled in water for thirty minutes for contraception purposes.
Indian Paintbrush.
Hopi women drank a tea of the whole Indian paintbrush to "Dry up the menstrual flow."

Blue Cohosh.
Chippewa women drank a strong decoction of the powdered blue cohosh root to promote parturition and menstruation.
Dogbane.
Generally used by many tribes, a tea from the boiled roots of the plant was drunk once a week.
Milkweed.
Navajo women drank a tea prepared of the whole plant after childbirth.
American Mistletoe.
Indians of Mendocino County drank a tea of the leaves to induce abortion or to prevent conception.
Antelope Sage.
To prevent conception, Navajo women drank one cup of a decoction of boiled antelope sage root during menstruation.
Stoneseed.
Shoshoni women of Nevada reportedly drank a cold water infusion of stoneseed roots everyday for six months to ensure permanent sterility.

COUGHS
Aspen.
The Cree Indians used an infusion of the inner bark as a remedy for coughs.
Wild Cherry.
The Flambeau Ojibwa prepared a tea of the bark of wild cherry for coughs and colds, while other tribes used a bark for diarrhea or for lung troubles.
White Pine.
The inner bark was used by Indian people as a tea for colds and coughs.
Sarsaparilla.
The Penobscots pulverized dried sarsaparilla roots and combined them with sweet flag roots in warm water and used the dark liquid as a cough remedy.

DIABETIES
Wild Carrot.
The Mohegans steeped the blossoms of this wild species in warm water when they were in full bloom and took the drink for diabetes.
Devil's Club.
The Indians of British Columbia utilized a tea of the root bark to offset the effects of diabetes.

DIARRHEA
Blackcherry.
A tea of blackberry roots was the most frequently used remedy for diarrhea among Indians of northern California.
Wild Black Cherry.
The Mohegans allowed the ripe wild black cherry to ferment naturally in a jar about one year than then drank the juice to cure dysentery.

Dogwood.
The Menominees boiled the inner bark of the dogwood and passed the warm solution into the rectum with a rectal syringe made from the bladder of a small mammal and the hollow bone of a bird.
Geranium.
Chippewa and Ottawa tribes boiled the entire geranium plant and drank the tea for diarrhea.
White Oak.
Iroquois and Penobscots boiled the bark of the white oak and drank the liquid for bleeding piles and diarrhea.
Black Raspberry.
The Pawnee, Omaha, and Dakota tribes boiled the root bark of black raspberry for dysentery.
Star Grass.
Catawbas drank a tea of star grass leaves for dysentery.

DIGESTIVE DISORDERS
Dandelion.
A tea of the roots was drunk for heartburn by the Pillager Ojibwas. Mohegans drank a tea of the leaves for a tonic.
Yellow Root.
A tea from the root was used by the Catawbas and the Cherokee as a stomach ache remedy.

FEVERS
Dogwood.
The Delaware Indians, who called the tree Hat-ta-wa-no-min-schi, boiled the inner bark in water, using the tea to reduce fevers.
Willow.
The Pomo tribe boiled the inner root bark, then drank strong doses of the resulting tea to induce sweating in cases of chills and fever. In the south, the Natchez prepared their fever remedies from the bark of the red willow, while the Alabama and Creek Indians plunged into willow root baths for the same purpose.
Feverwort.
The Cherokees drank a decoction of the coarse, leafy, perennial herb to cure fevers.

HEADACHE
Pennyroyal.
The Onondagas steeped pennyroyal leaves and drank the tea to cure headaches.

HEART and CIRCULATORY PROBLEMS
Green Hellebore.
The Cherokee used the green hellebore to relive body pains.
American Hemp and Dogbane.
Used by the Prairie Potawatomis as a heart medicine, the fruit was boiled when it was still green, and the resulting decoction drunk. It was also used for kidney problems and for dropsy.

HEMORRHOIDS
White Oak.
The Menominee tribe treated piles by squirting an infusion of the scraped inner bark of oak into the rectum with a syringe made from an animal bladder and the hollow bone of a bird.

INFLAMMATIONS and SWELLINGS
Witch Hazel.
The Menominees of Wisconsin boiled the leaves and rubbed the liquid on the legs of tribesmen who were participating in sporting games. A decoction of the boiled twigs was used to cure aching backs, while steam derived by placing the twigs in water with hot rocks was a favorite Potawatomi treatment for muscle aches.

INFLUENZA
Native Hemlock (as opposed Poison Hemlock of Socrates fame). The Menominees prepared a tea if the inner bark and drank it to relieve cold symptoms. A similar tea was used by the Forest Potawatomis to induce sweating and relieve colds and feverish conditions.

INSECT BITES and STINGS
Fendler Bladderpod.
The Navajos made a tea and used it to treat spider bites.
Purple Coneflower.
The Plains Indians used this as a universal application for the bites and stings of all crawling, flying, or leaping bugs. Between June and September, the bristly stemmed plant, which grows in dry, open woods and on prairies, bears a striking purplish flower.
Stiff Goldenrod.
The Meskwaki Indians of Minnesota ground the flowers into a lotion and applied it to bee stings.
Trumpet Honeysuckle.
The leaves were ground by chewing and then applied to bees stings.
Wild Onion and Garlic.
The Dakotas and Winnebagos applied the crushed bulbs of wild onions and garlics.
Saltbush.
The Navajos chewed the stems and placed the pulpy mash on areas of swelling caused by ant, bee and wasp bites. The Zunis applied the dried, powdered roots and flowers mixed with saliva to ant bites.
Broom Snakeweed.
The Navajos chewed the stem and applied the resin to insect bites and stings of all kinds.
Tobacco.
A favorite remedy for bee stings was the application of wet tobacco leaves.

INSECT REPELLENTS and INSECTICIDES
Goldenseal.
The Cherokee pounded the large rootstock with bear fat and smeared it on their bodies as an insect repellent. It was also used as a tonic, stimulant, and astringent.

RHEUMATISM
Pokeweed.
Indians of Virginia drank a tea of the boiled berries to cure rheumatism. The dried root was also used to allay inflammation.
Bloodroot.
A favorite rheumatism remedy among the Indians of the Mississippi region - the Rappahannocks of Virginia drank a tea of the root.

SEDATIVES
Wild Black Cherry.
The Meskwaki tribe made a sedative tea of the root bark.
Hops.
The Mohegans prepared a sedative medicine from the conelike strobiles and sometimes heated the blossoms and applied them for toothache. The Dakota tribe used a tea of the steeped strobiles to relieve pains of the digestive organs, and the Menominee tribe regarded a related species of hops as a panacea.
Wild Lettuce.
Indigenous to North American, it was used for sedative purposes, especially in nervous complaints.

THRUSH
Geranium.
The Cherokee boiled geranium root together with wild grape, and with the liquid, rinsed the mouths of children affected with thrush.
Persimmon.
The Catawba stripped the bark from the tree and boiled it in water, using the resulting dark liquid as a mouth rinse.

NOTE:THESE REMIDIES SHOULD NOT BE USED ABOVE YOUR DOCTORS ADVICE ! , HOWEVER YOU WILL FIND THAT THEY DO WORK.

Source: American Medicinal Plants. NY: Dover Publications

Traditional Native Herbs and Their
Uses in Healing, Native Recipes

There are hundreds of herbs with dozens of uses in Native American medicine, no room here to list all of them. You can find books and internet resources for more detailed information on specific herbs used by specific tribes. Below is just a small sampling. As with all other forms of herbal medicine, get a checkup before treating yourself with herbs, research each carefully for possible side effects. Get in touch with Native Americans who might be well-versed in herbs and healing.

Traditional healing herbs

* Burdock (Arctium lappa L.). Naturalized in North America, from Asia and Europe, this plant grows rom 2-5 ft.; can be found along roadsides and in all vacant lots. Hunters will remember Burdock burrs adhering to their clothes and being troublesome to their game dogs. The stems are stout with wide spreading branches carrying alternately elongated heart-shaped leaves. The purple flowers bloom in July and August, after which they dry out and the base becomes the troublesome burr. The root, which should be dug in the autumn or early spring, is thick, brownish-grey externally. with white pith-like tissue inside. The root and seeds have a sweetish taste, the leaves and stems being bitter.

Uses: Herbalists all over the world use Burdock. Such an effective and ultimate blood purifying plant has well earned the unpretending authentic value for which we know it is capable. The root and seed of Arctium lappa is a soothing demulcent, tonic, alterative; it slowly but steadily cleanses skin, soothes the kidneys, and relieves the lymphatic's; eliminates boils, carbuncles, canker sores, styes, felons, etc. Soothing to the mucous membrane throughout the entire system, and is also used for gout, rheumatism, scrofula, syphilis, sciatica, gonorrhea, and kidney diseases. Burdock is regarded as an excellent immune system strengthener, a tonic for the liver, kidneys and lungs as well as a blood purifier with the ability to neutralize poisons and cleanse the lymphatic system. Burdock contains proven anti-bacterial and anti-fungal as well as tumor-protective compounds. The leaves contain a substance which promotes bile secretion and may be included in liver and gall bladder formulas. An infusion or decoction of the root may be used as a skin wash for burns, ringworms. acne and rashes. A poultice using the leaf material will treat gout.

In the Orient, burdock root is used for its nutritive and strengthening qualities. In Hawaii it is known by the Japanese name 'Gobo root' and is used to increase strength and endurance and works even better when combined with other herbs. In China, where the seed pod is dried and used for coughs, colds, measles, boils and sore throats, burdock has been found listed as a useful medicine as early as 502 AD. Burdock has been used medicinally by many Native American tribes. Plains Indians adopted burdock for ceremonial use, and the Otos used a decoction of the root for pleurisy. Burdock root was an ingredient of a medicine used by Meskwaki women in labor. Flambeau Ojibwas used the root as part of a medicine for stomach pain, and supposed it to have a tonic effect. The Potawatomis made a burdock-root tea taken as a general tonic and blood purifier. Other tribes to use the root of burdock are the Creeks, Cherokees, Micmacs, Menomonee. Whites have used the root as an alterative in blood and skin diseases. EarthKeepers and their ancestors have been using Burdock in the Muscogee Tea™ for close to five hundred years with amazing results. Once used as a way to lift the spirits and connect to the heart by increasing the levels of joy one can experience for the conduct of ceremony, it is now referred to as a liver cleanse. We believe as the heart is the seat of love, compassion, joy, etc. the

liver is the seat of sudden outburst of anger, resentment, bitterness and the like. So when the liver is on its way to optimum health the heart benefits by receiving cleaner blood flow, hence better sources of oxygen, the life force, hence more opportunity to feel the joy life has to offer. Burdock root is a major ingredient of the Muscogee Tea™.

Precaution: Burdock may have estrogen-like effects and therefore should be avoided during pregnancy.

* Rabbit tobacco (Gnaphalium obtusifolium). These annual herbs reach a height of 1 to 3 feet and have erect stems with brown, shriveled leaves persisting into winter and stems covered with feltlike hairs in summer. The leaves are 1 to 3 inches long, and alternate. The flowers, minute in whitish heads, appear in late summer to fall. Fields, pastures, and disturbed areas are the sites of this common native plant of the eastern United States. It is used to treat colds, flu, neuritis, asthma, coughs, and pneumonia. This is one of the most popular plants used by the Lumbee. The decoction is drunk hot, like most medicinal teas, and is said to cause profuse sweating.

* Poke (Phytolacca americana). Also a common native plant of the eastern United States, poke is a robust, perennial herb that reaches a height of 9 feet. It has a large white root; a green, red, or purple stem; alternate leaves up to 1 foot long; and white flowers in a drooping raceme. The fruit is a dark purple to black berry, round, soft, and juicy. Poke is found in waste areas, road sides, disturbed habitats, fields, and pastures. It is used to treat asthma, spring tonic, boils (risings), sores, intestinal worms in people or chickens, cramps, and stomach ulcers. Poke is said to inhibit gram-positive and gram-negative bacteria and is listed as a parasiticide in the British Herbal Pharmacopoeia.

* Pine (Pinus echinata, P. palustris, P. virginiana). Pines are resinous evergreen trees with needlelike foliage leaves in bundles of two to five. The male and female reproductive structures are in separate cones on the same tree; the female cone matures to a large woody cone with winged seeds; pollen sheds in the spring. Pine is used to treat colds, flu, pneumonia, fever, heartburn, arthritis, neuritis, and kidney problems.

* Oak (Quercus laevis, Q. phellos). These deciduous trees have alternate, unlobed, or variously lobed leaves and minute flowers; the fruit is an acorn. Oak is used to treat kidney problems (including Bright's disease), bladder problems, virus, menstrual bleeding, diarrhea, sores, sprains, and swellings. It is also used as a booster for other remedies.

* Sassafras (Sassafras albidum). These deciduous, aromatic, small trees or shrubs have green twigs and--when mature--thick, furrowed bark. The leaves are 2.5 to 5 inches long; alternate; and either unlobed, lobed on one side, or three-lobed. Flowers are small and yellow in clusters at the end of twigs. The fruit is a dark blue, fleshy drupe on a bright red stalk and cup. This common native plant of fencerows,

woodland borders, and old fields of the eastern United States is used to treat measles, chicken pox, colds, flu, and fever. It is also used as a "shotgun heart remedy," a blood purifier, and a spring tonic.

According to the Handbook of Northeastern Indian Medicinal Plants Native American Indians used about 25 percent of the flora of Maryland for medicinal purposes (Duke, 1986). A few examples of medicinal plant species in Maryland are as follows:

* Sheep Sorrel (Acetosella vulgaris). Sheep sorrel is a perennial plant that grows in rocky areas throughout the world with the exception of the tropics. The plant is common along roadsides in England and is sometimes cultivated in the United States. The whole plant can be used before the stem is hollow in the second year. The roots are woody, long and tapering. The furrowed or streaked stem grows one to two feet high. The edible leaves are attached to the stem by a slender leaf stalk and are green, the pigment indicating a high amount of chlorophyll. Leaves are ovate with two lateral teeth. Upper part is oblong and narrow. Green flowers with reddish tinge distinguish from the orange-red female flowers. Sheep sorrel seeds are shiny, black, three-sided small seeds resembling peppercorn. Harvest the plant early in the day or in late afternoon May through August before it flowers and goes to seed in September.

The whole herb when young and in its freshest state acts as a diuretic and blood cleanser. The herb improves liver, intestinal and bowel functions, prevents destruction of red blood cells and is used to break down tumors. The chlorophyll in sheep sorrel carries oxygen through the bloodstream which strengthens cell walls, helps remove deposits in blood vessels and allows the body to store and use more oxygen. Chlorophyll may also reduce radiation damage and restrict chromosome damage. The herb is smooth and acid while the root has astringent properties and contains a substance allied to crysophanic acid (an iron-greening tannin diuretic). Sheep sorrel is taken for inflammatory diseases, tumors, incipient cancers and urine and kidney diseases. The action is refrigerant, diaphoretic and diuretic.

*Slippery Elm (Ulmus fulva). Slippery elm can be found in northern and central United States and eastern Canada. It grows in moist woods and bottom land, along streams, as well as in dry soil. The rough branches and long, tough, hairy leaves help distinguish slippery elm which resembles a small tree and can grow up to sixty feet tall. The dark green or yellowish leaves are covered with yellow wool and have orange tips, while the bark is deeply furrowed. The pinkish white, fibrous inner bark contains the healing properties. The inner bark can be obtained whole or powdered. In its powdered state it is pale pink brown in color.

Slippery elm is good for nervous problems, stomach and intestines, sore throats and coughs. It contains inulin which helps the liver, spleen and pancreas. The herb promotes urination, disperses swelling and acts as a laxative. Chinese medicine listed the herb in 25 BC and noted that it is good for diarrhea, ulcers, soothing inflamed colon, small intestine and colon meridians. It has a sweet flavor with a neutral property. Indians used it as a demulcent, salve, and laxative. Some believe it may help diabetic conditions.

*Turkey Rhubarb (Rheum palmatum). Turkey rhubarb somewhat resembles the garden variety rhubarb (rheum rhaponticum) but medicinally is suite a bit stronger. A perennial, the herb is identified by its conical, fleshy root stock with yellow interior. The seven-lobed, heart-shaped or rounded leaves grow twelve inches in length and are attached by thick petioles to stems five to ten feet tall. Topping the hollow flower stem is a leafy panicle of greenish or whitish flowers. Turkey rhubarb is cultivated in China and Tibet for decorative as well as medicinal purposes.

Turkey rhubarb has been used for centuries for its dual action as a laxative and astringent as well as a purging treatment. In smaller doses it is used to treat diarrhea or to stimulate the appetite. Larger amounts yield a laxative effect. The herb stimulates the colon and abates distension while promoting bile flow, clearing stasis and restoring the stomach and liver. It has used as a stomach tonic to soothe digestion; to cleanse the liver; as an anti-tumor; and an aid for thermal burns, jaundice, sores and cancers. As a regulator, turkey rhubarb has both contractive and dilative properties that help regulate menstruation and eliminative processes. It is versatile in preparations as a balancing herb and anthelmintic In Chinese medicine, its properties are considered bitter and cold entering the stomach, colon, liver, spleen and pericardium meridians. Functions to drain heat and dampness, moves stools, cools blood, disperses and invigorates stagnant blood.

* Sweetflag or calamus (Acorus). The root has been used to treat flatulence, colds, coughs, heart disease, bowel problems, colic, cholera, suppressed menses, dropsy, gravel, headache, sore throat, spasms, swellings, and yellowish urine. Some tribes considered the root a panacea; others thought it had mystic powers.

* Bloodroot (Sanguinaria). This very poisonous plant is emetic, laxative, and emmenagogue. It has been used to treat chronic bronchitis, diphtheria, sore throat, uterine and other cancers, tetterworm, deafness, and dyspepsia; it has also been used as a pain reliever and sedative. In Appalachia it is carried as a charm to ward off evil spirits.

* Yellowdock. Contains anthraquinones of value in the treatment of ringworm and some types of psoriasis. Rumicin from the roots reportedly destroys skin parasites. The anthraquinones are proven laxatives.

* Coneflower (Echinacea, Rudbeckia). Echinacea (purple coneflower) reportedly increases resistance to infection, bad coughs, dyspepsia, venereal disease, insect bites, fever, and blood poisoning.

* Witch hazel. A proven astringent and hemostat (to stop bleeding).

* Lobelia (Lobelia cardinalis). Cardinal flower was used to indurate ulcers and to treat stomachache, syphilis, and worms. The leaf tea was used for cold, croup, epistaxis (nosebleed), fever, headache,

rheumatism, and syphilis. Lobelia inflata (Indian tobacco) yields lobeline sulfate, used in antitobacco therapy. It is used as an antiasthmatic, an expectorant, and a stimulant for bronchitis; it also is used to treat aches, asthma, boils, croup, colic, sore throat, stiff neck, and tuberculosis of the lungs. Some smoked the herb to break a tobacco habit.

* Mayapple (Podophyllum peltatum). Early Native American Indians used the roots as a strong purgative, liver cleanser, emetic, and worm expellant. A resin made from the plant has been used to treat venereal warts and exhibits antitumor activity; it also is used for snakebite and as an insecticide for potato bugs.

* Wild cherry (Prunus virginiana). The bark has been used to treat sores and wounds, diarrhea, cold and cough, tuberculosis, hemoptysis, scrofula, sore throat, stomach cramps, and piles. Native American Indians treated snow blindness by leaning over a kettle of boiling bark "tea." Some smoked the bark for headache and head cold.

* White willow (Salix alba). The bark is astringent, expectorant, hemostatic, and tonic. It is used to treat calluses, cancers, corns, tumors, and warts. Salicylic acid (used to make aspirin) is found in white willow. Leaves and bark of different willows are used in a tea to break a fever. Some Native American Indians burned willow stems and used the ashes to treat sore eyes.

History of Herbal Medicine

Early humans recognized their dependence on nature in both health and illness. Led by instinct, taste, and experience, primitive men and women treated illness by using plants, animal parts, and minerals that were not part of their usual diet. Physical evidence of use of herbal remedies goes back some 60,000 years to a burial site of a Neanderthal man uncovered in 1960 (Solecki, 1975). In a cave in northern Iraq, scientists found what appeared to be ordinary human bones. An analysis of the soil around the bones revealed extraordinary quantities of plant pollen that could not have been introduced accidentally at the burial site. Someone in the small cave community had consciously gathered eight species of plants to surround the dead man. Seven of these are medicinal plants still used throughout the herbal world (Bensky and Gamble, 1993). All cultures have long folk medicine histories that include the use of plants. Even in ancient cultures, people methodically and scientifically collected information on herbs and developed well-defined herbal pharmacopoeias. Indeed, well into the 20th century much of the pharmacopoeia of scientific medicine was derived from the herbal lore of native peoples. Many drugs, including strychnine, aspirin, vincristine, taxol, curare, and ergot, are of herbal origin. About one-

quarter of the prescription drugs dispensed by community pharmacies in the United States contain at least one active ingredient derived from plant material (Farnsworth and Morris, 1976).

Middle East medicine. The invention of writing was a focus around which herbal knowledge could accumulate and grow. The first written records detailing the use of herbs in the treatment of illness are the Mesopotamian clay tablet writings and the Egyptian papyrus. About 2000 B.C., King Assurbanipal of Sumeria ordered the compilation of the first known materia medica--an ancient form of today's United States Pharmacopoeia--containing 250 herbal drugs (including garlic, still a favorite of herbal doctors). The Ebers Papyrus, the most important of the preserved Egyptian manuscripts, was written around 1500 B.C. and includes much earlier information. It contains 876 prescriptions made up of more than 500 different substances, including many herbs (Ackerknecht, 1973).

Greece and Rome. One of the earliest materia medica was the Rhizotomikon, written by Diocles of Caryotos, a pupil of Aristotle. Unfortunately, the book is now lost. Other Greek and Roman compilations followed, but none was as important or influential as that written by Dioscorides in the 1st century A.D., better known by its Latin name De Materia Medica. This text contains 950 curative substances, of which 600 are plant products and the rest are of animal or mineral origin (Ackerknecht, 1973). Each entry includes a drawing, a description of the plant, an account of its medicinal qualities and method of preparation, and warnings about undesirable effects.

Muslim world. The Arabs preserved and built on the body of knowledge of the Greco-Roman period as they learned of new remedies from remote places. They even introduced to the West the Chinese technique of chemically preparing minerals. The principal storehouse of the Muslim materia medica is the text of Jami of Ibn Baiar (died 1248 A.D.), which lists more than 2,000 substances, including many plant products (Ackerknecht, 1973). Eventually this entire body of knowledge was reintroduced to Europe by Christian doctors traveling with the Crusaders. Indeed, during the Middle Ages, trade in herbs became a vast international commerce.

East India. India, located between China and the West, underwent a similar process in the development of its medicine. The healing that took place before India's Ayurvedic medical corpus was similar to that of ancient Egypt or China (i.e., sickness was viewed as a punishment from the gods for a particular sin). Ayurvedic medicine emerged during the rise of the philosophies of the Upanishads, Buddhism, and other schools of thought in India. Herbs played an important role in Ayurvedic medicine. The principal Ayurvedic book on internal medicine, the Characka Samhita, describes 582 herbs (Majno, 1975). The main book on surgery, the Sushruta Samhita, lists some 600 herbal remedies. Most experts agree that these books are at least 2,000 years old.

China and Japan. The earliest written evidence of the medicinal use of herbs in China consists of a corpus of 11 medical works recovered from a burial site in Hunan province. The burial itself is dated 168 B.C., and the texts (written on silk) appear to have been composed before the end of the 3rd century B.C. Some of the texts discuss exercise, diet, and channel therapy (in the form of moxibustion--see the "Alternative Systems of Medical Practice" chapter). The largest, clearest, and most important of these manuscripts, called by its discoverers Prescriptions for Fifty-Two Ailments, is predominantly a pharmacological work. More than 250 medicinal substances are named. Most are substances derived from herbs and wood; grains, legumes, fruits, vegetables, and animal parts are also mentioned. Underlying this entire text is the view that disease is the manifestation of evil spirits, ghosts, and demons that must be repelled by incantation, rituals, and spells in addition to herbal remedies.

By the Later Han Dynasty (25-220 A.D.), medicine had changed dramatically in China. People grew more confident of their ability to observe and understand the natural world and believed that health and disease were subject to the principles of natural order. However, herbs still played an important part in successive systems of medicine. The Classic of the Materia Medica, compiled no earlier than the 1st century A.D. by unknown authors, was the first Chinese book to focus on the description of individual herbs. It includes 252 botanical substances, 45 mineral substances, and 67 animal-derived substances. For each herb there is a description of its medicinal effect, usually in terms of symptoms. Reference is made to the proper method of preparation, and toxicities are noted (Bensky and Gamble, 1993).

Since the writing of the Classic of the Materia Medica almost 2,000 years ago, the traditional Chinese materia medica have been steadily increasing in number. This increase has resulted from the integration into the official tradition of substances from China's folk medicine as well as from other parts of the world. Many substances now used in traditional Chinese medicine originate in places such as Southeast

Asia, India, the Middle East, and the Americas. The most recent compilation of Chinese materia medica was published in 1977. The Encyclopedia of Traditional Chinese Medicine Substances (Zhong yao da ci dian), the culmination of a 25-year research project conducted by the Jiangsu College of New Medicine, contains 5,767 entries and is the most definitive compilation of China's herbal tradition to date (Bensky and Gamble, 1993).

Traditional Chinese medicine was brought to Japan via Korea, and Chinese-influenced Korean medicine was adapted by the Japanese during the reign of Emperor Ingyo (411-453 A.D.). Medical envoys continued to arrive from Korea throughout the next century, and by the time of the Empress Suiko (592-628 A.D.), Japanese envoys were being sent directly to China to study medicine. Toward the end of the Muromachi period (1333-1573 A.D.) the Japanese began to develop their own form of traditional oriental medicine, called kampo medicine. As traditional Chinese medicine was modified and integrated into kampo medicine, herbal medicine was markedly simplified.

Herbal Medicine in the United States

In North America, early explorers traded knowledge with the Native American Indians. The tribes taught them which herbs to use to sharpen their senses for hunting, to build endurance, and to bait their traps. In 1716, French explorer Lafitau found a species of ginseng, Panax quinquefolius L., growing in Iroquois territory in the New World. This American ginseng soon became an important item in world herb commerce (Duke, 1989). The Jesuits dug up the plentiful American ginseng, sold it to the Chinese, and used the money to build schools and churches. Even today, American ginseng is a sizable crude U.S. export.

As medicine evolved in the United States, plants continued as a mainstay of country medicine. pproaches to plant healing passed from physician to physician, family to family. Even in America's recent past, most families used home herbal remedies to control small medical emergencies and to keep minor ailments from turning into chronic problems. During this period there was a partnership between home folk medicine and the family doctor (Buchman, 1980). Physicians often used plant and herbal reparations to treat common ills. Until the 1940s, textbooks of pharmacognosy--books that characterize plants as proven-by-use prescription medicines--contained hundreds of medically useful comments on barks, roots, berries, leaves, resins, twigs, and flowers.

As 20th-century technology advanced and created a growing admiration for technology and echnologists, simple plant-and-water remedies were gradually discarded. Today, many Americans have lost touch with their herbal heritage. Few Americans realize that many over-the-counter (OTC) and

prescription drugs have their origins in medicinal herbs. Cough drops that contain menthol, mint, horehound, or lemon are herbal preparations; chamomile and mint teas taken for digestion or a nervous stomach are time-honored herbal remedies; and many simple but effective OTC ache-and pain-relieving preparations on every druggist's and grocer's shelf contain oils of camphor, menthol, or eucalyptus. Millions of Americans greet the morning with their favorite herbal stimulant--coffee.

Despite the importance of plant discoveries in the evolution of medicine, some regulatory bodies such as the U.S. Food and Drug Administration (FDA)--the main U.S. regulatory agency for food and drugs--consider herbal remedies to be worthless or potentially dangerous (Snider, 1991). Indeed, today in the United States, herbal products can be marketed only as food supplements. If a manufacturer or distributor makes specific health claims about a herbal product (i.e., indicates on the label the ailment or ailments for which the product might be used) without FDA approval, the product can be pulled from store shelves.

Despite FDA's skepticism about herbal remedies, a growing number of Americans are again becoming interested in herbal preparations. This surge in interest is fueled by factors that include the following:

* Traditional European and North American herbs are sold in most U.S. health food stores. The same is true for Chinese and, to a lesser extent, Japanese herbal medicinals. Ayurvedic herbals are available in most large U.S. cities, as are culinary and medicinal herb shops called botanicas that sell herbs from Central and South America and Mexico. The reemergence of Native American Indian cultural influences has increased interest in Native American Indian herbal medicines.

* Pharmaceutical drugs are seen increasingly as overprescribed, expensive, even dangerous. Herbal remedies are seen as less expensive and less toxic.

* Exposure to exotic foreign foods prepared with non-European culinary herbs has led many Euroethnic Americans to examine and often consider using medicinal herbs that were brought to the United States along with ethnic culinary herbs.

* People increasingly are willing to "self-doctor" their medical needs by investigating and using herbs and herbal preparations. Many Americans--especially those with chronic illnesses such as arthritis, diabetes, cancer, and AIDS--are turning to herbs as adjuncts to other treatments.

The next section discusses the regulatory status of herbal medicine in various countries around the world, particularly in Europe and Asia, as well as in less developed countries. It is followed by an overview of promising European and Asian herbal medicine research and recommendations for making herbal medicine a more viable health care alternative in this country.

Regulatory Status of Herbal Medicine Worldwide

The World Health Organization (WHO) estimates that 4 billion people--80 percent of the world population--use herbal medicine for some aspect of primary health care (Farnsworth et al., 1985). Herbal medicine is a major component in all indigenous peoples' traditional medicine and is a common element in Ayurvedic, homeopathic, naturopathic, traditional oriental, and Native American Indian medicine (see the "Alternative Systems of Medical Practice" chapter).

The sophistication of herbal remedies used around the world varies with the technological advancement of countries that produce and use them. These remedies range from medicinal teas and crude tablets used in traditional medicine to concentrated, standardized extracts produced in modern pharmaceutical facilities and used in modern medical systems under a physician's supervision.

Europe

Drug approval considerations for phytomedicines (medicines from plants) in Europe are the same as those for new drugs in the United States, where drugs are documented for safety, effectiveness, and quality. But two features of European drug regulation make that market more hospitable to natural remedies. First, in Europe it costs less and takes less time to approve medicines as safe and effective. This is especially true of substances that have a long history of use and can be approved under the "doctrine of reasonable certainty." According to this principle, once a remedy is shown to be safe, regulatory officials use a standard of evidence to decide with reasonable certainty that the drug will be effective. This procedure dramatically reduces the cost of approving drugs without compromising safety. Second, Europeans have no inherent prejudice against molecularly complex plant substances; rather, they regard them as single substances.

The European Economic Community (EEC), recognizing the need to standardize approval of herbal medicines, developed a series of guidelines, The Quality of Herbal Remedies (EEC Directive, undated). These guidelines outline standards for quality, quantity, and production of herbal remedies and provide labeling requirements that member countries must meet. The EEC guidelines are based on the principles of the WHO's Guidelines for the Assessment of Herbal Medicines (1991). According to these guidelines,

a substance's historical use is a valid way to document safety and efficacy in the absence of scientific evidence to the contrary. (App. C contains the complete WHO guidelines.) The guidelines suggest the following as a basis for determining product safety:

A guiding principle should be that if the product has been traditionally used without demonstrated harm, no specific restrictive regulatory action should be undertaken unless new evidence demands a revised risk-benefit assessment. . . . Prolonged and apparently uneventful use of a substance usually offers testimony of its safety.

With regard to efficacy, the guidelines state the following:

For treatment of minor disorders and for nonspecific indications, some relaxation is justified in the requirements for proof of efficacy, taking into account the extent of traditional use; the same considerations may apply to prophylactic use (WHO, 1991).

The WHO guidelines give further advice for basing approval on existing monographs:

If a pharmacopoeia monograph exists it should be sufficient to make reference to this monograph. If no such monograph is available, a monograph must be supplied and should be set out in the same way as in an official pharmacopoeia.

To further the standardization effort and to increase Europeanscientific support, the phytotherapy societies of Belgium, France,Germany, Switzerland, and the United Kingdom founded the European Societies' Cooperative of Phytotherapy (ESCOP). ESCOP's approach toeliminating problems of differing quality and therapeutic use withinEEC is to build on the German scientific monograph system (below) to create "European" monographs.

In Europe, herbal remedies fall into three categories. The most rigorously controlled are prescription drugs, which include injectable forms of phytomedicines and those used to treat life-threatening diseases. The second category is OTC phytomedicines, similar to American OTC drugs. The third category is traditional herbal remedies, products that typically have not undergone extensive clinical testing but are judged safe on the basis of generations of use without serious incident.

The following brief overviews of phytomedicine's regulatory status in France, Germany, and England are representative of the regulatory status of herbal medicine in Europe.

France, where traditional medicines can be sold with labeling based on traditional use, requires licensing by the French Licensing Committee and approval by the French Pharmacopoeia Committee. These products are distinguished from approved pharmaceutical drugs by labels stating "Traditionally used for . . ." Consumers understand this to mean that indications are based on historical evidence and have not necessarily been confirmed by modern scientific experimentation (Artiges, 1991).

Germany considers whole herbal products as a single active ingredient; this makes it simpler to define and approve the product. The German Federal Health Office regulates such products as ginkgo and milk thistle extracts by using a monograph system that results in products whose potency and manufacturing processes are standardized. The monographs are compiled from scientific literature on a particular herb in a single report and are produced under the auspices of the Ministry of Health Committee for Herbal Remedies (Kommission E). Approval of such remedies requires more scientific documentation than traditional remedies, but less than new pharmaceutical drug approvals (Keller, 1991).

In Germany there is a further distinction between "prescription-only drugs" and "normal prescription drugs." The former are available only by prescription. The latter are covered by national health insurance if prescribed by a physician, but they can be purchased over the counter without a prescription if consumers want to pay the cost themselves (Keller, 1991). OTC phytomedicines--used for self-diagnosed, self-limiting conditions such as the common cold, or for simple symptomatic relief of chronic conditions--are not covered by the national health insurance plan.

England generally follows the rule of prior use, which says that hundreds of years of use with apparent positive effects and no evidence of detrimental side effects are enough evidence--in lieu of other scientific data--that the product is safe. To promote the safe use of herbal remedies, the Ministry of Agriculture, Fisheries, and Food and the Department of Health jointly established a database of adverse effects of nonconventional medicines at the National Poisons Unit.

Asia

In more developed Asian countries such as Japan, China, and India, "patent" herbal remedies are composed of dried and powdered whole herbs or herb extracts in liquid or tablet form. Liquid herb extracts are used directly in the form of medicinal syrups, tinctures, cordials, and wines.

In China, traditional herbal remedies are still the backbone of medicine. Use varies with region, but most herbs are available throughout China. Until 1984 there was virtually no regulation of pharmaceuticals or herbal preparations. In 1984, the People's Republic implemented the Drug Administration Law, which aid that traditional herbal preparations were generally considered "old drugs" and, except for new uses, were exempt from testing for efficacy or side effects. The Chinese Ministry of Public Health would oversee the administration of new herbal products (Gilhooley, 1989).

Traditional Japanese medicine, called kampo, is similar to and historically derived from Chinese medicine but includes traditional medicines from Japanese folklore. Kampo declined when Western medicine was introduced between 1868 and 1912, but by 1928 it had begun to revive. Today 42.7 percent of Japan's Western-trained medical practitioners prescribe kampo medicines (Tsumura, 1991), and Japanese national health insurance pays for these medicines. In 1988, the Japanese herbal medicine industry established regulations to manufacture and control the quality of extract products in kampo medicine. Those regulations comply with the Japanese government's Regulations for Manufacturing Control and Quality Control of Drugs.

Developing Countries

Herbal medicines are the staple of medical treatment in many developing countries. Herbal preparations are used for virtually all minor ailments. Visits to Western-trained doctors or prescription pharmacists are reserved for life-threatening or hard-to-treat disorders.

Individual herbal medicines in developing regions vary considerably; healers in each region have learned over centuries which local herbs have medicinal worth. Although trade brings a few important herbs from other regions, these healers rely mainly on indigenous herbs. Some have extensive herbal materia medica. A few regions, such as Southeast Asia, import large amounts of Chinese herbal preparations. But the method and form of herb use are common to developing regions.

In the developing world, herbs used for medicinal purposes are "crude drugs." These are unprocessed herbs--plants or plant parts, dried and used in whole or cut form. Herbs are prepared as teas sometimes as pills or capsules) for internal use and as salves and poultices for external use. Most developing countries have minimal regulation and oversight.

Research Base

The professional literature of Europe and Asia abounds with efficacy and safety studies of many herbal medicines. It is beyond this report's resources to investigate the validity of this vast literature. The following is an overview of some of the more promising research on herbal remedies around the world.

Europe

European phytomedicines, researched in leading European universities and hospitals, are among the world's best studied medicines. In some cases they have been in clinical use under medical supervision for more than 10 years, with tens of millions of documented cases. This form of botanical medicine most closely resembles American medicine. European phytomedicines are produced under strict quality ontrol in sophisticated pharmaceutical factories, packaged and labeled like American medicines, and used in tablets or capsules.

Examples of well-studied European phytomedicines include Silybum marianum (milk thistle), Ginkgo biloba (ginkgo), Vaccinium myrtillus (bilberry extract), and Ilex guayusa (guayusa). Their efficacy is well documented. Herbs of American origin, such as Echinacea (purple coneflower) and Serenoa repens (saw palmetto), are better studied and marketed in Europe than in the United States. Below is an overview of recent research on these phytomedicines and American herbs.

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* Milk thistle (Silybum marianum). Milk thistle has been used as a liver remedy for 2,000 years. In 1970s studies, seed extracts protected against liver damage and helped regenerate liver cells damaged by

toxins (alcohol) and by diseases such as hepatitis (Bode et al., 1977) and cirrhosis (Ferenci et al., 1989). More recently, a 6-month treatment of milk thistle significantly improved liver function in 36 patients with alcohol-induced liver disease (Feher et al., 1990). Animal studies show that it may protect against radiation damage caused by x rays (Flemming, 1971), and it gave "complete protection" to rats against brain damage caused by the potent nerve toxin triethyltin sulfate (Varkonyi et al., 1971). European hospital emergency rooms use intravenous milk thistle extract to counteract cases of liver poisoning from toxins such as those in the Amanita phalloides mushroom.

* Bilberry extract (Vaccinium myrtillus). Bilberry extract is believed to help prevent or treat fragile capillaries. Capillary fragility can cause fluid or blood to leak into the tissues, causing hemorrhage, stroke, heart attack, or blindness. Less serious effects include a tendency to bruise easily, varicose veins, poor night vision, coldness, numbing, and leg cramping. Bilberry extract may protect capillaries and other small blood vessels by increasing the flexibility of red blood cell membranes. This action allows capillaries to stretch, increasing blood flow, and red blood cells can deform into a shape that eases their way through narrow capillaries.

European clinical trials have shown the effectiveness of bilberry extract for venous insufficiency of the lower limbs in 18-to 75-year-old subjects (Corsi, 1987; Guerrini, 1987). It has been used to treat varicose veins in the legs, where it significantly improved symptoms of varicose syndrome such as cramps, heaviness, calf and ankle swelling, and numbness (Gatta, 1982). These trials revealed no significant side effects, even at 50 percent over the normal dose. In two clinical trials, a standardized bilberry extract was given to 115 women with venous insufficiency and hemorrhoids following pregnancy. Both studies documented improvements of symptoms, including pain, burning, and pruritus, all of which disappeared in most cases (Baisi, 1987; Teglio et al., 1987).

* Ginkgo biloba extract. Though this oriental herb has a different traditional use in Asia, Ginkgo biloba is one of Europe's most lucrative phytomedicines (Duke, 1988). In Europe, ginkgo is used mainly against symptoms of aging. It is believed to stimulate circulation and oxygen flow to the brain, which can improve problem solving and memory. It was shown to increase the brain's tolerance for oxygen deficiency and to increase blood flow in patients with cerebrovascular disease (Haas, 1981). No other known circulatory stimulant, natural or synthetic, has selectively increased blood flow to disease-damaged brain areas. In a French study, "the results confirmed the efficacy of [ginkgo extract] in cerebral disorders due to aging" (Taillandier et al., 1988). In another experiment, those given ginkgo showed consistent and significant improvement over the control group on all tests, including mobility, orientation, communication, mental alertness, recent memory, and other factors (Weitbrecht and Jansen, 1985). A "digit copying test" and a computerized classification test confirmed the improved cognitive function related to use of this herb (Rai et al., 1991).

Ginkgo extracts also stimulate circulation in the limbs, reducing coldness, numbness, and cramping. In elderly people, ginkgo improved pain-free walking distance by 30 percent to 100 percent (Foster, 1990).

It also lowered high cholesterol levels in 86 percent of cases tested and prevented oxygen deprivation of the heart (Schaffler and Reeh, 1985). The extract seems to affect neurons directly, as shown by a recent French study (Yabe et al., 1992). Another French study proved protection against cell damage, this time by ultraviolet light (Dumont et al., 1992).

A German study documented benefits of long-term ginkgo use in reducing cardiovascular risks, including those associated with coronary heart disease, hypertension, hypercholesterolemia, and diabetes mellitus (Witte et al., 1992). By maintaining blood flow to the retina, ginkgo extracts inhibited deteriorating vision in the elderly. An adequate amount of extract may reverse damage from lengthy oxygen deprivation of the retina. The assessment by doctors and patients of the patients' general condition showed a significant improvement after therapy. These results show that visual field damage from chronic lack of blood flow is reversible (Raabe et al., 1991).

* Ilex guayusa (guayusa). In animal studies, a concentrated aqueous herbal preparation from guayusa leaves significantly reduced uncontrolled appetite, excessive thirst, and weight loss associated with diabetes (Swanston-Flatt et al., 1989). Although guayusa's active principles are not established, guayusa contains guanidine, a known hypoglycemic (blood sugar-lowering) substance (Duke, 1992b).

* Echinacea (purple coneflower). The subject of more than 350 scientific studies, most conducted in Europe, Echinacea seems to stimulate the immune system nonspecifically rather than against specific organisms. In laboratory tests, Echinacea increased the number of immune system cells and developing cells in bone marrow and lymphatic tissue, and it seemed to speed their development into immunocompetent cells (cells that can react to pathogens). It speeds their release into circulation, so more are present in blood and lymph, and increases their phagocytosis rate--the rate at which they can digest foreign bodies. Echinacea also inhibits the enzyme hyaluronidase, which bacteria use to enter tissues and cause infection. This inhibition helps wounds to heal by stimulating new tissue formation.

Echinacea exhibits interferonlike antiviral activity documented through extensive experiments in Germany. For example, in a double-blind, placebo-controlled study of 180 volunteers, Echinacea's therapeutic effectiveness for treating flu-like symptoms was "good to very good" (Braunig et al., 1992). Another study showed that orally administered Echinacea extracts significantly enhanced phagocytosis in mice (Bauer et al., 1988). Water-soluble Echinacea components strongly activated macrophages (Stimpel et al., 1984), enhanced immune system cell motility, and increased these cells' ability to kill bacteria. Other immune system cells were stimulated to secrete the disease-fighting tumor necrosis factor and interleukins 1 and 6 (Roesler et al., 1991). Another study showed that Echinacea polysaccharides increased the number of immunocompetent cells in the spleen and bone marrow and the migration of those cells into the circulatory system. The authors said these effects resulted in excellent protection of mice against consequences of lethal listeria and candida infections (Coeugniet and Elek, 1987).

* Saw palmetto (Serenoa repens). These berries have been used to treat benign prostatic hypertrophy (BPH). The standardized extract was clinically evaluated as effective, has no observed side effects, and costs 30 percent less than the main prescription drug marketed in the United States for BPH Champpault et al., 1984).

Another effective herbal drug for treating BPH is made from Prunus africanum and is widely prescribed in France. It is interesting to note that the U.S. government is funding a multicenter study on BPH treatment to find the most cost-effective criteria for surgical versus medical treatment. However, because the study includes neither saw palmetto nor Prunus africanum, it may not reflect the "state of the art" in clinical medicine worldwide.

China

Since the early 19th century, attempts have been made to understand the actions and properties of traditional Chinese medicine through scientific research. Nearly all of this work has been conducted during the past 60 years, primarily in laboratories in China, Korea, Japan, Russia, and Germany. It was also during this time that most of the drugs used in modern biomedicine were developed. It is therefore not surprising that most of the biomedical research into the effects and uses of traditional Chinese medicinal substances has attempted to isolate their active ingredients and to understand their effects on body tissues.

Several institutions and laboratories at the forefront of medicinal plant research in China are working to identify and study the active ingredients in traditional Chinese herbal remedies. Researchers at the Institute of Materia Medica in Beijing study the use of herbal remedies to prevent and treat the common cold, bronchitis, cancer, and cardiovascular disease and to prevent conception. The institute has isolated compounds such as bergenin from Ardisia japonica, traditionally used to treat chronic bronchitis, and monocrotaline from Crotalaria sessiliflora, used in folk medicine to treat skin cancer. Most of China's 5,000 medicinal plant species are represented in the institute's herbarium. Other Chinese research organizations with major programs on medicinal herbs are the Institute of Chinese Medicine, Beijing; the Institute of Materia Medica, Shanghai; the Institute of Organic Chemistry, Shanghai; the Municipal Hospital of Chinese Traditional Medicine, Beijing; the College of Pharmacy, Nanking; and the Department of Organic Chemistry and Biochemistry, Beijing University (Duke and Ayensu, 1985).

Many herbs in China have been extensively studied by using methods acceptable from a Western perspective. For example, a 1992 article in the Journal of Ethnopharmacology reported that during the preceding 10 years more than 300 original papers on Panax ginseng had been published in Chinese and English (Liu and Xiao, 1992). Ginseng is one of the world's most thoroughly researched herbs. Following is an overview of recent research on ginseng and other herbs in China. Unless otherwise indicated, the

data on specific herbs are taken from Chinese Herbal Medicine: Materia Medica, revised edition, compiled and translated by Dan Bensky and Andrew Gamble (1993).

* Ginseng root (Panax ginseng [ren shen]). The Chinese first used oriental ginseng (Panax ginseng) more than 3,000 years ago as a tonic, a restorative, and a specific treatment for several ailments. By the 10th century, oriental ginseng had traveled the Silk Road to the Arabic countries (Kao, 1992), and during the next 4 centuries it spread to Europe, where the French, among others, used it to treat asthma and stomach troubles (Vogel, 1970).

In modern times, ginseng has been extensively studied in China, Japan, and Korea and, to a lesser degree, in the United States. In its various forms, ginseng or its compounds have various physiological effects. These include antistress capabilities (Cheng et al., 1986; Yuan et al., 1988), antihypoxia effects (Cheng et al., 1988; Han et al., 1979; Qu et al., 1988), alteration of circadian rhythms by modifying neurotransmitters (Lu et al., 1988; Zhang and Chen, 1987), cardiac performance effects (Chen et al., 1982), protection against myocardial infarction in animals (Chen, 1983; Fang et al., 1986), histamine response effects (Zhang et al., 1988), inhibition of platelet aggregation (Shen et al., 1987; Yang et al., 1988), alteration of circadian variation of plasma corticosterone (Li et al., 1988), modulation of immune functions (Qian et al., 1987; Wang et al., 1980), and delay of the effects of aging (Tong and Chao, 1980; Zhang, 1989).

* Fresh ginger rhizome (Zingiber officinale [sheng jiang]). In one study, preparations of sheng jiang and brown sugar were used to treat 50 patients with acute bacillary dysentery. A cure rate of 70 percent was achieved in 7 days. Abdominal pain and tenesmus (an urgent but ineffectual attempt to urinate or defecate) disappeared in 5 days, stool frequency returned to normal in 5 days, and stool cultures were negative within 4 days, with no side effects.

In another study, 6 to 10 thin pieces of sheng jiang placed over the testes were used to treat acute orchitis (inflammation of the testicles). The ginger was changed daily or every other day. All participants felt a hot-to-numbing sensation in the scrotum, while a few reported local erythema and edema. Among 24 patients in the study, average cure time was 3 days. In a control group of four patients, average healing time was 8.5 days. This technique is not recommended for patients with scrotum lesions.

* Chinese foxglove root (Rehmannia glutinosa [sheng di huang]). A preparation of this herb and Radix glycyrrhiza uralensis (gan cao) was used to treat 50 cases of hepatitis in various stages. Within 10 days, 41 cases showed improved symptoms, reduced liver and spleen size, and improved liver function tests. Experiments from the 1930s seemed to show that sheng di huang, given to rats via gastric lavage or injection, lowered serum glucose levels. Later studies of this problem showed variable results. Work in Japan showed that the herb is useful in treating experimental hyperglycemia in rats. In other studies, decoctions of sheng di huang have been used to treat rheumatoid arthritis in adults and children. In one

uncontrolled study, 12 subjects all showed reduced joint pain and swelling, increased function, improved nodules and rash, and lowered temperature. Followup over 3 to 6 months showed only one relapse, which was treated successfully with the same preparation.

* Baical skullcap root (Scutellaria baicalensis [huang qin]). Huang in was shown to inhibit the skin reaction of guinea pigs to passive allergic and histamine tests. It has been shown to be effective in treating guinea pigs with allergic asthma. Huang qin also prevented pulmonary hemorrhage in mice subjected to very low pressure. Huang qin has an inhibitory effect against many kinds of bacteria in vitro, including Staphylococcus aureus, Corynebacterium diphtheriae, Pseudomonas aeruginosa, Streptococcus pneumoniae, and Neisseria meningitidis. In one report, one strain of bacteria (Staph. aureus) that was resistant to penicillin remained sensitive to this herb. According to one study, 100 patients with bacillary dysentery received a prescription composed mainly of huang qin. Mean recovery times were 2.5 days until symptoms disappeared, 3.3 days until normal stool examination, and 4.3 days until negative stool cultures.

* Coptis rhizome, or yellow links (Coptis chinensis [huang lian]). Huang lian and one of its active ingredients, berberine, have broad effects in vitro against many microbes. It strongly inhibits many bacteria that cause dysentery; it is more effective than sulfa drugs but less effective than streptomycin or chloramphenicol. Decoctions of huang lian have been effective against some bacteria that developed resistance to streptomycin and other antibiotics. The herb's antimicrobial ingredient is generally considered to be berberine. Experiments on chicken embryos show that huang lian has an inhibitory effect against flu viruses and the Newcastle virus.

Huang lian preparations have a strong inhibitory effect in vitro against many pathogenic fungi. Capsules of powdered huang lian were given to patients with typhoid fever, with good results. In one report, two cases that were resistant to antimicrobials responded to this herb. In another study, 30 cases of pulmonary tuberculosis were treated with huang lian for 3 months; all improved.

A 10-percent solution of huang lian also was used to treat 44 cases of scarlet fever. It was as effective as penicillin or a combination of penicillin and a sulfa drug. Huang lian also has been successfully used to treat diphtheria; in one study, the fever subsided in 1 to 3 days. Huang lian ointments or solutions promoted healing and reduced infections in first-and second-degree burns. It also has positive effects on blood pressure, smooth muscle, lipid metabolism, and the central nervous system; is effective as an anti-inflammatory; and has been used successfully in gynecology, ophthalmology, and dermatology patients.

* Woad leaf (Isatis tinctoria [da qing ye]). Da qing ye kills some kinds of bacteria, including some strains resistant to sulfa drugs. It was reported effective in hundreds of cases of encephalitis B, with cure rates of 93 percent to 98 percent. In most cases the fever subsided in 1 to 4 days, and symptoms disappeared

3 to 5 days later. Da qing ye has been effective by itself in mild and moderate cases; other herbs, acupuncture, and Western drugs should be added in severe cases.

In a study of 100 subjects, only 10 percent of the group given a da qing ye decoction twice daily had upper respiratory infections during the study period versus 24 percent of the control group. When a mixture of decoctions of da qing ye and Herba taraxaci mongolici cum radice (pu gong ying) was given to 150 children with measles, signs and symptoms disappeared in 4 to 5 days. In 68 of 100 cases, da qing ye was used successfully to treat infectious hepatitis.

* Wild chrysanthemum flower (Chrysanthemum indicum [ye ju hua]). Ye ju hua has been used to treat hypertension, either alone as an infusion or with Elos lonicerae japonicae (jin yin hua) and Herba taraxaci mongolici cum radice (pu gong ying) in a decoction. Ye ju hua preparations have an inhibitory effect in vitro against some bacteria and viruses. Preparations given orally or as injections lowered blood pressure. Preparations made from the whole plant had more toxicity and less efficacy than those made from the flower alone.

One study was performed with 1,000 subjects to see whether ye ju hua would prevent colds. The subjects were compared with their own histories and against a matched set of 261 controls. A ye ju hua decoction was taken once a month by people with histories of infrequent colds, twice a month by those with three to five colds a year, and weekly by those with frequent colds. Comparison with their own histories showed a 13.2-percent reduction in frequency, but a greater frequency in comparison with the controls. At the same time, another clinical series of 119 cases of chronic bronchitis was observed. Using the same preparation, this group experienced a 38-percent reduction in acute attacks in comparison with their seasonally adjusted rate for the previous year.

* Bletilla rhizome (Bletilla striata [bai ji]). Bai ji, in powdered form or in a powder made from starch and a decoction of bai ji, helped control bleeding in seven of eight cases of surgical wounds to dogs' livers. Pure starch was much less effective. Similar results have been achieved with sponges soaked in a sterile water-extraction solution of the herb. In anesthetized dogs with 1-mm-diameter stomach perforations, washing the perforations with 9 g of powdered bai ji through a tube closed the perforations in 15 minutes. Eight hours after the procedure the abdomens were opened, and no trace of gastric contents was found. When the dogs' stomachs were full or the perforations were larger, powdered bai ji had no effect.

In another study, powdered bai ji was used to treat 69 cases of bleeding ulcers, and in all cases the bleeding stopped within 6.5 days. In another series of 29 perforated ulcer cases, the powdered herb was successful in 23 cases, 1 required surgery, and the other 4 died (1 went into hemorrhagic shock while under treatment, and the other 3 were in precarious condition on admission).

In other studies, powdered bai ji was given to 60 chronic tuberculosis patients who had not responded to normal therapy. After taking the herb for 3 months, 42 were clinically cured, 13 significantly improved, and 2 showed no change. A sterile ointment made from decocted bai ji and petroleum jelly was used in a local application to treat 48 cases of burns and trauma (less than 11 percent of total body area). Dressings were changed every 5 to 7 days, and all patients recovered within 1 to 3 weeks.

* Salvia, or cinnabar root (Salvia miltiorrhiza [dan shen]). Dan shen caused coronary arteries to dilate in guinea pig and rabbit heart specimens. In one study of 323 patients given a dan shen preparation for 1 to 9 months, there was marked improvement in 20.3 percent of clinical cases and general improvement in 62 percent of cases. Results were best when patients had coronary artery disease and no history of myocardial infarction. In a clinical series of more than 300 patients with angina pectoris, a combination of dan shen and Lignum dalbergiae odoriferae (jiang xiang) given intramuscularly or intravenously improved symptoms in 82 percent and electrocardiograms in 50 percent of cases.

* Corydalis rhizome (Corydalis yanhusuo [yan hu suo]). Yan hu suo is widely used to treat pain. Powdered yan hu suo is a very strong analgesic, about 1 percent the strength of opium. In one clinical study of 44 patients with painful or difficult menstruation, 50 mg of the yan hu suo active ingredient, dihydrocorydaline, given 3 times a day brought significant relief in 14 cases and reduced pain in another 18 cases. Side effects included reductions in menstrual flow, headaches, and fatigue.

* Root of Szechuan aconite (Aconitum carmichaeli [fu zi]). Fu zi's toxicity has always been a major concern. It is usually prepared with salt to reduce its toxicity. Anesthetized dogs or cats given fu zi preparations showed a sharp drop in blood pressure. In another experiment, fu zi caused blood vessels to dilate in lower extremities and coronary vessels. In normal dosage for humans, fu zi slightly lowers blood pressure, while a large overdose can cause rapid heartbeat or ventricular fibrillation. This herb seems to have some cardiotonic function and a regulatory effect on heart rhythm. Administered with herbs such as Cortex cinnamomi cassiae (rou gui), Panax ginseng (ren shen), Rhizoma zingiberis officinalis (gan jiang), and Radix glycyrrhiza uralensis (gan cao), fu zi raised blood pressure in animals with acute hemorrhage. In one study, patients with congestive heart failure were treated by ntramuscular injections of a fu zi preparation. In all cases, including one of cardiogenic shock, the result was increased cardiac output as well as decreased breathing difficulty, liver swelling, and general edema. A few cases showed temporary side effects of flushing and slight tremors.

* Licorice root (Glycyrrhiza uralensis [gan cao]). Gan cao preparations have been used with common antituberculosis drugs in many large clinical studies among patients who did not respond to standard treatment. In most cases, symptoms improved or disappeared and x rays improved markedly. In many clinical studies using gan cao for ulcers with groups of 50 to 200 subjects, effectiveness was around 90 percent. It was especially useful to treat the pain, which disappeared or improved within 1 to 3 weeks.

The more recent the onset of disease, the better the results. In almost all cases the powdered herb was most effective.

In rats with experimentally induced atherosclerosis, gan cao lowered cholesterol levels and stopped progression of lesions. In several experiments, the herb reduced the toxicity of some substances, including cocaine, and moderately reduced the toxicity of others, including caffeine and nicotine. When decocted with fu zi, it sharply reduced fu zi's toxicity.

* Dryopteris root, or shield fern (Dryopteris crassirhizoma [guan zhong]). Dryopteris crassirhizoma is called dong bei guan zhong because it is found in northeastern (dong bei) China. In recent times this herb has been prescribed as a preventive measure during influenza epidemics. Guan zhong preparations strongly inhibit the flu virus in vitro. In one clinical trial, 306 people took twice-weekly doses of guan zhong and 340 served as controls. In the treatment group, 12 percent became ill versus 33 percent of the controls. Local versions of guan zhong from Guangdong, Hunan, and Jiangxi provinces have mildly inhibitory effects in vitro against many pathogenic bacteria. Guan zhong also is effective against pig roundworms in vitro, and it expels tapeworms and liver flukes in cattle.

In other studies, decoctions and alcohol extracts of dong bei guan zhong strongly stimulated the uterus of guinea pigs and rabbits. It increased the frequency and strength of contractions. Intramuscular injections of dong bei guan zhong preparations were used with more than 91-percent success to treat postpartum, postmiscarriage, and postsurgical bleeding.

* Garlic bulb (Allium sativum [da suan]). Da suan preparations have a strong inhibitory effect in vitro against amebae. In one study, concentrated da suan decoctions were used to treat 100 cases of amebic dysentery. The cure rate was 88 percent, and the average hospital stay was 7 days. In this clinical study, purple-skinned bulbs were more effective than white-skinned bulbs. Patients were discharged on a regimen that included purple-skinned da suan in the daily diet.

When used with Chinese leek seeds, da suan juice and decoctions have a strong inhibitory effect in vitro against many pathogenic bacteria. Da suan can be effective against bacteria that resist penicillin, streptomycin, and chloramphenicol. In one clinical study, 130 patients with bacillary dysentery were given da suan enemas. Of the followup colonoscopies, 126 showed that pathological changes were resolved within 6.3 days. In other studies with hundreds of patients, da suan's effectiveness against acillary dysentery was more than 95 percent. Again, purple-skinned garlic seemed more effective than white-skinned, and fresh bulbs were more effective than old ones. In one clinical study, 17 cases of ncephalitis B were treated with an intravenous drip of da suan preparations and supportive care. Except for one fatality, all other cases recovered.

India

Ayurveda, the oldest existing medical system, is recognized by WHO and is widely practiced. The word comes from two Sanskrit roots: ayus means life or span; veda means knowledge or science. India recently increased research on traditional Ayurvedic herbal medicines after observations that they are effective for conditions to which they have traditionally been applied. For example, the ancient Sanskrit text on Ayurveda, the Sushruta Samhita, noted that Commiphora mukul was useful in treating obesity and conditions equivalent to hyperlipidemia, or increased concentrations of cholesterol in the body. The plant has been used by Ayurveda practitioners for at least 200 years and may have been in use since the writing of the Sushruta Samhita more than 2,000 years ago. In a recent study, the crude gum from Commiphora mukul significantly lowered serum cholesterol in rabbits with high cholesterol levels. The plant substance also protected rabbits from cholesterol-induced atherosclerosis (hardening of the arteries). This finding led to pharmacological and toxicological studies that showed this herbal remedy to be effective in humans, with no adverse side effects. Approval was obtained from the national regulatory authority in India for further clinical trials (Verma and Bordia, 1988). The drug is marketed in India and other countries for treatment of hyperlipidemia (Chaudhury, 1992).

The following other Ayurvedic herbs have recently been studied in India under modern scientific conditions:

* Eclipta alba. In Ayurvedic medicine, Eclipta alba is said to be the best drug for treating liver cirrhosis and infectious hepatitis. Eclipta alba and Wedelia calendulacea are widely used in India for jaundice and other liver and gall bladder ailments. One recent study showed that a liquid extract from fresh Eclipta leaves was effective in vivo in preventing acute carbon tetrachloride-induced liver damage in guinea pigs. Clinically, the powdered drug is effective against jaundice in children (Wagner et al., 1986).

* Common teak tree (Tectona grandis). Trunk wood and bark of the common teak tree are described in Ayurvedic medicine as a cure for chronic dyspepsia (indigestion) associated with burning pain. Teak bark forms an ingredient of several Ayurvedic preparations used to treat peptic ulcer. Pandey et al. (1982) experimentally screened teak bark and its effect on gastric secretory function and ulcers in albino rats and guinea pigs. The solution reduced gastric ulcers in restrained albino rats and significantly inhibited gastric and duodenal ulcers in guinea pigs.

* Indian gooseberry (Emblica officinalis [amla]). Jacob et al. (1988) studied the effect of total serum cholesterol by using amla to supplement the diets of normal and hypercholesterolemic men aged 35-55. The supplement was given for 28 days in raw form. Normal and hypercholesterolemic subjects showed decreased cholesterol levels. Two weeks after the supplement was withdrawn, total serum cholesterol levels of the hypercholesterolemic subjects rose almost to initial levels.

* Picrorhiza kurroa. P. kurroa rhizomes are main ingredients of a bitter tonic used in fever and dyspepsia (indigestion). This drug occupies a prestigious position in Ayurveda. It often substitutes for Gentiana kurroo, the Indian gentian. Powdered rhizomes also are used as a remedy for asthma, bronchitis, and liver diseases. Other researchers have reported that a P. kurroa-derived mixture called kutkin exhibits hepatoprotective activity; that P. kurroa acts as a bile enhancer; that it has antiasthmatic effects in patients with chronic asthma; and that it has immunomodulating activity in cell-mediated and humoral immunity. Another study (Bedi et al., 1989) shows that P. kurroa works to boost the immune system as a supplement to other treatments in patients with vitiligo, a skin disease that causes discolored spots.

* Articulin-F. This herbomineral formula contains roots of Withania somnifera, stem of Boswellia serrata, rhizomes of Curcuma longa, and a zinc complex. Kulkarni et al. (1991) performed a randomized, double-blind, placebo-controlled crossover study of articulin-F to treat osteoarthritis, a common progressive rheumatic disease characterized by degeneration and eventual loss of articular cartilage. Articulin-F treatment produced a significant drop in pain severity and disability score, whereas radiological assessment showed no significant changes.

* Abortifacient plants. Nath et al. (1992) organized a survey program in Lucknow and Farrukhabad, two towns in Uttar Pradesh, India, from March to July 1987. During the survey, they recorded the common folk medicine used by women and consulted Ayurvedic and Unani drug encyclopedias for the antireproductive potential of the following medicinal plants: leaves of Adhatoda vasica, leaves of Moringa oleifera, seeds of Butea monosperma, seeds of Trachyspermum ammai, flowers of Hibiscus sinensis, seeds of Abrus precatorius, seeds of Apium petroselinium, buds of Bambusa arundensis, leaves of Aloe barbadensis, seeds of Anethum sowa, seeds of Lepidium sativum, seeds of Raphanus sativus, seeds of Mucuna pruriens, seeds of Sida cordifolia, seeds of Blepharis edulis, flowers of Acacia arabica, and seeds of Mesua ferrea. Plant materials were collected, authenticated, chopped into small pieces, air dried in shade, and then ground to a 60-mesh powder. During the survey, female rats were given aqueous or 90-percent ethanol extracts of the plants orally for 10 days after insemination by males, with special attention to effects on fetal development. Leaf extracts of Moringa oleifera and Adhatoda vasica were 100-percent abortive at doses equivalent to 175 mg/kg of starting dry material.

* Neem (Azadiractica indica) and turmeric (Curcuma longa). In the Ayurveda and Sidha systems of medicine, neem and turmeric are used to heal chronic ulcers and scabies. Charles and Charles (1991) used neem and turmeric as a paste to treat scabies in 814 people. Ninety-seven percent of cases were cured within 3 to 15 days. The researchers found this to be a cheap, easily available, effective, acceptable mode of treatment for villagers in developing countries, with no adverse reactions.

* Trikatu. Trikatu is an Ayurvedic preparation containing black pepper, long pepper, and ginger. It is prescribed routinely for several diseases as part of a multidrug prescription. These herbs, along with piperine (alkaloid of peppers), have biological effects in mammals, including enhancement of other medicaments. Of 370 compounds listed in the Handbook of Domestic Medicines and Common

Ayurvedic Remedies (Handbook, 1979), 210 contain trikatu or its ingredients. Trikatu is a major decoction used to restore the imbalance of kapha, vata, and pitta, the body's three humors (see the "Alternative Systems of Medical Practice" chapter). Piper species are used internally to treat fevers, gastric and abdominal disorders, and urinary difficulties. Externally they are used to treat rheumatism, neuralgia, and boils. P. longum and P. nigrum are folklore remedies for asthma, bronchitis, dysentery, pyrexia, and insomnia (Akamasu, 1970; Chopra and Chopra, 1959; Perry, 1980; Youngken, 1950). In Chinese folklore, P. nigrum is mentioned as a treatment for epilepsy (Pei, 1983). The efficacy of P. longum fruits in reducing asthma in adults (Upadhyaya et al., 1982) and children has been reported (Dahanukar et al., 1984). P. nigrum promoted digestive juice secretion (Shukla, 1984) and increased appetite (Sumathikutty et al., 1979). P. longum was reported useful in patients with gastric disorders accompanied by clinical symptoms of achlorhydria (Kishore et al., 1990).

Barriers to Herbal Medicine Research in the United States

The regulatory lockout of natural remedies has crippled natural products research in U.S. universities and hospitals. There is no dedicated level of support by the Federal Government for herbal medicine research. Herbalists may apply under existing guidelines for approval of new pharmaceutical drugs, but this burden is unrealistic because the total cost of bringing a new pharmaceutical drug to market in the United States is an estimated $140 million to $500 million (Wall Street Journal, 1993). Because botanicals are not patentable (although they can be patented for use), an herbal medicine manufacturer could never recover this expenditure. Therefore, herbal remedies are not viable candidates for the existing drug approval process: pharmaceutical companies will not risk a loss of this magnitude, and herb companies lack the financial resources even to consider seeking approval.

Another major barrier is that the academic infrastructure necessary for proper study of ethnomedical systems has seriously eroded in recent decades and must be reinvigorated to accommodate the newly recognized need for preserving traditional medical systems and biological diversity. Pharmacognosy and other academic studies of medicinal plants have declined alarmingly in the United States. North American scientists, once at the forefront of this research, lag behind their European and Japanese colleagues, reducing the likelihood that they will discover useful new medicines from plants. This problem is exacerbated by the fact that much of the discipline of botany has moved away from field studies and into molecular and laboratory approaches. Today only a handful of active full-time ethnobotanists are trained to catalog information on the medicinal properties of plants.

In contrast to the United States, many European and Asian countries have taken a more holistic approach to researching the efficacy of herbal remedies. In Germany, France, and Japan, the past 20 years have seen a rapid increase in research into and use of standardized, semipurified (still containing multiple individual chemicals) herbal extracts called phytomedicines. In Europe and Japan, phytomedicines treat conditions ranging from serious, life-threatening diseases such as heart disease and cancer to simple symptomatic relief of colds, aches and pains, and other conditions treated by OTC drugs in the United States. Phytomedicines include preventive medicines, an often-neglected area of medicine in the United States. The FDA has approved many plant-derived "heroic" cures, but never a plant-derived preventive medicine.

Research Needs and Opportunities

Much modern-day medicine is directly or indirectly derived from plant sources, so it would be foolish to conclude that plants offer no further potential for the treatment or cure of major diseases. Worldwide, the botanical pharmacopoeia contains tens of thousands of plants used for medicinal purposes. hundreds, perhaps thousands, of definitive texts, monographs, and tomes on herbal remedies exist. But most of this information is outside current databases and remains unavailable to physicians, researchers, and consumers.

Globally, herbal remedies have been researched under rigorous controls and have been approved by the governments of technologically advanced nations. The scientific validation is good to excellent, and the history of clinical use is even stronger. Many phytomedicines have been used by thousands of physicians in their practices and are consumed under medical supervision by tens of millions of people.

A great deal of literature exists on the use of phytomedicines in Europe and within native medical systems in China, Japan, India, and North America. Much of this literature can be found in a unique database developed and maintained by the University of Illinois at Chicago, College of Pharmacy. The database, NAPRALERT (Natural Products Alert), holds references for more than 100,000 scientific articles and books on natural products (plant, microbial, and animal extracts). NAPRALERT includes considerable data on the chemistry and pharmacology (including human studies) of secondary metabolites of known structure, derived from natural sources. About 80 percent of the references are from post-1975 literature, the rest from pre-1975 literature (see the "Research Databases" chapter for more information on NAPRALERT).

In 1981 the U.S. Department of Agriculture (USDA), in conjunction with the National Cancer Institute, concluded a 25-year study of plants with possible anticancer properties. One result is published in the

Handbook of Medicinal Herbs (Duke and Ayensu, 1985). This work lists 365 folk medicinal species and identifies more than 1,000 pharmacologically active phytochemicals. Toxicity estimates are given for many of these biologically active compounds. More recently, Dr. James Duke of USDA published databases on biologically active compounds of more than 1,000 species of plants with potential medicinal uses (Duke, 1992a, 1992b). Duke proposed to FDA a computer-calculated toxicity index to parallel the Ames Human Exposure Rodent Potency (HERP) index for carcinogenicity. He calls his index the Better Understanding of Relative Potency (BURP) index.

Much of the literature on traditional Chinese and other Asian countries' herbal medicine is only now beginning to be translated into English. While much of this information is in the form of folklore, there is a growing body of data from scientifically valid literature on herbal medicine research in China as well as India and Japan. In 1986, the book Chinese Herbal Medicine: Materia Medica was published by Dan Bensky and Andrew Gamble, both of whom are fluent in Chinese dialects and studied herbal medicine in Asia. Revised in 1993 (Bensky and Gamble, 1993), it presents an indepth study of 470 herbs used in traditional Chinese medicine. Each entry details the traditional properties, actions and indications, principal combinations, dosage, and contraindications of the herbs, as well as summaries of abstracts regarding pharmacological and clinical research conducted in Asia. The revised edition also provides a brief description of the appearance of each herb.

Although very little laboratory or clinical research has been performed on Native American Indian herbal remedies, extensive listings of herbs and their uses have been compiled by ethnobotanists for several tribes. One source, American Indian Medicine (Vogel, 1970), cites references in the professional ethnobotanical literature on herbal medicines for the following tribes: Alabama-Koasati, Arakara, Algonquian, Arapaho, Aztec, Catawba, Cheyenne, Chickasaw, Choctaw, Comanche, Congaree, Creek, Dakota, Delaware, Hoh, Hopi, Houma, Huron, Illinois-Miami, Iroquois, Kwakiutl, Lake St. John Montagnais, Mayan, Menomini, Mescalero Apache, Malecite, Meswaki, Michigan, Mohawk, Mohegan, Natchez, Navajo, Nebraska, Oglala Sioux, Ojibwa, Omaka, Pawnee, Penobscot, Ponca, Potawatomi, Quileute, Rappahannock, San Carlos Apache, Seminole, Sioux, White Mountain Apache, Ute, Winnebago, Yuma, and Zuni. Moerman's database (Moerman, 1982) lists more than 2,000 species of Native American Indian medicinal plants, and Duke (1986) lists more than 700 eastern ones.

These sources--the NAPRALERT database, USDA laboratory research, the Bensky and Gamble book, and the Native American Indian herbal medicinal books--are the foundation on which the U.S. Government, particularly the National Institutes of Health (NIH), can begin substantial research into herbal medicines.

Much unwritten knowledge resides in the hands of healers in many societies where oral transmission of information is the rule. Unfortunately, in many regions this information is endangered because there are no young apprentices to whom elderly healers can pass on their unwritten wisdom; the knowledge that has been refined over thousands of years of experimentation with herbal medicine is being lost. A major research opportunity in this area would be to catalog information on herbal medicines from thousands

of traditional healers in cultures where these skills are normally transmitted through an apprentice system. Some organizations have recently increased their efforts to catalog endangered herbal knowledge from traditional medical systems in Latin America, such as those practiced in the rain forests of Belize (Arvigo and Balick, 1993) and Peru (Duke and Martinez, in press).

Basic Research Priorities

Basic research into characterizing these plant products and compounds in terms of standardized content and potential toxicity is needed to allow safe and replicable research to document clinical efficacy. Basic science research should be conducted to evaluate research on the biochemical effects of traditional herbal prescriptions from Western, Ayurvedic, oriental, and other traditions (see the "Alternative Systems of Medical Practice" chapter).

Clinical Research Priorities

Research in phytomedicines in the United States could follow on the results of existing high-quality European and Asian research on plant medicines and should focus on replicating results of key studies or addressing weaknesses in those studies. Reviews of foreign literature and translations of non-English literature would be helpful. Current widespread use of herbal medications as "food supplements" in the United States provides a ready base of users, producers, and practitioners for clinical research in traditional and modern applications of botanical medicine.

Key Research Issues

Before a comprehensive research agenda is developed, several key issues must be addressed, including the following: the impending loss of knowledge about traditional healing in many societies; the impending loss of large numbers of plant species of potential medicinal value; impediments to the use of herbal remedies outside the cultures in which they originated; and determination of the conditions

under which herbal medicines are most appropriate, safe, and effective. Additionally, several regulatory issues hamper research into herbal medicines.

Loss of Knowledge

The knowledge of traditional healers in remote Amazonian or Central American regions may have the potential to make a significant contribution to Western society. But few, if any, practitioners of these lesser known medical systems practice outside their native range, and those who still practice within these regions are elderly and often have not found younger disciples.

Loss of Plant Species of Potential Medicinal Value

This loss of knowledge from traditional healers comes at a time when native flora in many areas, especially tropical regions, are being destroyed at an alarming pace. In the United States alone, an estimated 10 percent of all species of flowering plants will be extinct by the year 2000, including an estimated 16 species of medicinally useful plants (Farnsworth et al., 1985).

One hopeful sign is that the U.S. Government recently formed a cooperative biodiversity group including representatives from NIH, the National Institute of Mental Health, the National Science Foundation (NSF), and the U.S. Agency for International Development. This group intends to fund research to locate and catalog medicinally active substances that can be analyzed and used for new pharmaceutical drug development, while working to preserve biological diversity in developing countries.

Use in Practice

Basic to the use of medicinal herbs in many societies is the practice of using whole, unrefined plant material. The material may be leaves, buds, flowers, bark, or roots, separately or in combination. In some cases an herbal remedy is a complex mixture of many plants. There is an age-old belief that whole-

plant medicines have fewer dangerous side effects and provide a more balanced physiological action than plant-derived pharmaceutical drugs whose single ingredient has been isolated, concentrated, and packaged as a pill or liquid.

Herbs and herbal preparations generally are self-administered. Often they are purchased through native herbalists who prescribe one or more herbs or preparations on the basis of medical and health approaches that often include concepts of attaining balance in the client's body, psychology, and spirit (see the "Community-Based Medical Practices" section of the "Alternative Systems of Medical Practice" chapter). Consequently, it is often difficult to assess the relative value of herbal remedies versus prescription drugs on a one-to-one basis.

Indeed, herbal remedies of all types, including those from China, are composed of a multitude of ingredients whose interactions with the body are exceedingly complex. A high level of sophistication of research methodology is necessary to describe the interaction between the human body and substances as complex as those contained in many herbal remedies. Only recently has such a rigorous methodology begun to be developed. For example, the Chinese herb Herba hedyotidis diffusae (bai hua she she cao) has been shown clinically effective in the prevention and treatment of a variety of infectious diseases. However, it has not been demonstrated to have a significant inhibitory effect in vitro against any major pathogen. Only as techniques became available to test the immunological system did it become apparent that at least part of the herb's effect was due to its enhancement of the body's immune response (Bensky and Gamble, 1993).

Another complicating factor in researching traditional Chinese herbal medicine is the fact that Chinese medicine characteristically tries to treat the whole body to alleviate disease stemming from one body organ. Therefore, it rarely relies on a single herb to treat an illness. Instead, formulas usually contain 4 to 12 different herbs (Duke and Ayensu, 1985).

Beyond the problem of trying to test herbal preparations that may contain many active ingredients is the question of whether the research eventually will lead to the isolation of single active ingredients that can be packaged and sold separately. Intense debate surrounds the issue of how to conduct clinical trials of herbal medicines according to Western pharmaceutical clinical standards. Critics say there is an inherent problem with the single-active-ingredient approach preferred by pharmaceutical companies that are actively involved in herbal medicine research. The problem, they say, is that isolating a single compound may not be the most appropriate approach in situations where a plant's activity decreases on further fractionation (separation of active ingredients by using solvents) or where the plant contains two or three active ingredients that must be taken together to produce the full effect (Chaudhury, 1992). Beckstrom-Sternberg and Duke (1994) have documented several cases where synergy has been lost by using the single-ingredient approach to developing drugs from plants.

A good example of this single-active-ingredient versus whole-plant debate is illustrated by intense interest among pharmaceutical companies in the compound called genistein. Genistein is part of a class of compounds called flavonoids that occur naturally in plants such as kudzu, licorice, and red clover. oybeans contain high concentrations of genistein, and lima beans reportedly are even higher in genistein than soybeans (Duke, 1993). There is increasing evidence that genistein may inhibit the growth of cancers of the stomach (Yanagihara et al., 1993), pancreas (Ura et al., 1993), liver (Mousavi and Adlercreutz, 1993), and prostate (Peterson and Barnes, 1993). Genistein is believed to inhibit the growth of cancers because of its antiangiogenetic properties (i.e., it prevents the growth of new blood vessels--a process known as angiogenesis--to tumors).

Genistein is being intensely studied as a possible preventive or treatment for breast cancer, which kills an estimated 44,000 women in the United States each year (Duke, 1993). Studies indicate a correlation between a high intake of foods containing genistein (soy products) and a low incidence of hormone-dependent cancers such as breast cancer (Hirayama, 1986) and prostate cancer (Baker, 1992). The growth of certain cancers, especially breast cancers, has been shown to depend on the female sex hormone estrogen. Genistein exhibits estrogenlike activity in plants and is often called a phytoestrogen. In humans it binds to estrogen receptors (Baker, 1992). It has been suggested that these phytoestrogens may compete with endogenous estrogen on the cellular level, further reducing the cellular proliferation and the potentially carcinogenic effects of estrogen (Tang and Adams, 1981). Thus, it may prevent the growth of estrogen-dependent cancer by competing for estrogen sites on the tumor cells.

If genistein is developed as an isolated pharmaceutical drug, it may have some action against cancer, but the purified compound may not be as potent as genistein in its natural state, and trials may give misleading results. The reason is that all plant species containing genistein also contain other flavonoid compounds, which may have synergistic effects when ingested with genistein. Formononetin--a precursor of equol, which also occurs with genistein--is said to be more active estrogenically than genistein (Spanu et al., 1993). Although genistein clearly inhibits angiogenesis, several other compounds are pseudoestrogens. With this in mind, the question arises: Is a mixture of genistein, formononetin, and other flavonoids, as occurs in many plants, more estrogenic (and antiangiogenic) than an equivalent quantity of any one of these components? If so, the herbal or dietary approach may make more sense than a genistein "silver bullet" approach.

Safety, Efficacy, and Appropriateness

Opinions about the safety, efficacy, and appropriateness of medicinal herbs vary widely among medical and health professionals in countries where herbal remedies are used. Some countries' professionals accept historical, empirical evidence as the only necessary criterion for herbal medicine's efficacy. Others would ban all herbal remedies as dangerous or of questionable value.

The problem is further complicated by the fact that many "patent medicines" available in world trade often are sold as herbal medicinal preparations when they include nonherbal substances. These nonherbal additives often include toxic metals (cinnabar, i.e., mercury) (Kang-Yum and Oransky, 1992), poisonous substances (powdered scorpion), or refined prescription drugs (Catlin et al., 1993). Usually labeled "Chinese herbal medicine," many of these products are manufactured in Thailand, Taiwan, or Hong Kong and exported to the United States, where they are sold in retail outlets. The California Department of Health Services, in conjunction with the Oriental Herbal Association, recently published a list of 20 popular Asian patent medicines (see app. E) that contain toxic ingredients.

Regulatory Issues

The increased use of plant medicines has potential for improving public health and lowering health care costs. Phytomedicines, if combined with the preventive model of medical practice, could be among the most cost-effective, practical ways to shift the focus of modern health care from disease treatment to prevention. But drug regulatory policy prevents the United States from taking advantage of these phytomedicines for two reasons. The first is the exorbitant expense involved in investigating each chemical compound in a given plant extract before it can be tested for clinical usefulness. Hence there is an urgent need to rework current research guidelines to allow the whole plant material or combination mixture (an herbal remedy containing more than one plant) to be evaluated instead of requiring separate evaluations of each chemical component of the therapeutic ingredients.

The second reason is that regulatory requirements for proof of safety and efficacy constitute an economic disincentive for private industry to conduct additional scientific studies. Relaxing regulatory requirements for efficacy for herbal products might make it economically feasible for more private companies to pursue research into issues of safety and quality control. Even with such regulatory change, some public funding of research is needed to confirm the remedies' validity. Public funds are needed because private industry has no incentive to develop an herbal product that might displace a patented drug from an approved treatment regime.

Recommendations

The Panel on Herbal Medicine recommends the following:

* OAM should hold a research organizational conference to facilitate planning in herbal medicine research. The conference would help to identify state-of-the-art questions in ethnomedical research, existing databases, and research personnel needed to support basic and clinical research needs in this area.

* Federal funding agencies such as NSF and NIH must begin to support the training of ethnobotanists--specifically in the field of ethnomedicine--and to offer funding opportunities to foster the rebirth of this field at U.S. universities and research institutions. This is a critical priority because much traditional knowledge in herbal remedies is in danger of disappearing, as are the plant species used in these systems of medicine.

* The bias against plant medicines must be eliminated by restructuring the requirements for proof of efficacy and concentrating on safety, and by removing the need for extensive analyses of chemically complex natural product medicines (thus eliminating the "monosubstance bias"). Several international regulatory models exist to guide the United States in this direction. For example, the German "Kommission E" (expert committee for herbal remedies) monographs give a good example of how the United States might simplify the approval of natural products without sacrificing safety or quality standards. (The "doctrine of reasonable certainty" that influences the approval of drugs under this system was previously mentioned.)

Adopting a more realistic standard of evidence for established plant medicines would eliminate much of the expense required for approval of new and unknown chemical drugs. Doing so would be similar to having standardized the crude drug senna leaf, used in the United States as an OTC laxative and documented for safety, effectiveness, and quality.

Another option might be to require pharmaceutical companies that are testing a plant-derived, single-ingredient pharmaceutical on a specific condition to demonstrate that it is more effective than the natural product. For example, before a patent could be issued to a pharmaceutical company for an isolated compound such as genistein, the company would first have to prove that the isolated compound is more effective than genistein consumed in context (as a food). But some market incentive,

such as exclusive prescriptive marketing rights, might be needed to allow the pharmaceutical company to recoup its research costs.

* Legislative action may be required to restate FDA's mandate with respect to herbal products and traditional medications. The current regulatory mandate puts FDA in a difficult position. It is expected to "protect the public" but has no expertise or resources to evaluate the global herbal medicine inventory. If a crisis such as the contaminated tryptophan affair (see the "Diet and Nutrition" chapter) were to occur with a popular herbal product, FDA might attempt to prohibit the sale of medicinal herbs altogether. Instead of expecting FDA to be an omnipotent protector, Congress should legislate a more educational, informational role.

With respect to herbs used in popular health care, a proactive FDA role in establishing quality and safety standards would benefit the public and industry. A certification system for herbal content and potency of marketed products could be set up by FDA with USDA and the herbal industry. Such a system could draw on the existing global database and other countries' regulatory experiences. Participation in a voluntary product certification system would be a marketing advantage for ethical producers, allowing them, for example, to make a statement such as "This product meets U.S. government purity and potency standards." New statutory authority also would be necessary to establish a category that would allow traditional usages to be listed on labels according to criteria similar to WHO guidelines.

Finally, if herbal remedy producers were given the option to apply for specific health condition label indications based on new FDA phytomedicine standards, the United States would have the same three-tiered regulatory system adopted by other developed countries. Such a voluntary system would let consumers make intelligent personal choices about the use of medicinal herb products while mandating safety standards consistent with existing OTC practices for potentially toxic drugs such as aspirin and ibuprofen.

* OAM should review the TRAMIL approach, in which distinguished Caribbean botanists, chemists, ethnologists, and physicians review promising herbs and label them as reasonably safe and effective for people who cannot afford the prescription alternatives.

http://www.earthkeepers.net/eagle/nativePlants.html