

The science of traditional medicine

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I first learned about traditional medicine from my family, through a centuries-old oral tradition based on generations of experience. I remember my grandmother telling me how to prepare a tonic, with careful detailed directions on where, when, and how to collect the plant parts and how to prepare the medicinal drink. Most families in the community prepared different tonics seasonally and my grandmother learned to use this medicine from her mother.

More recently, I have come to understand the plants and their bioactivity from studies in Biology and Pharmacognosy. The latter is a branch of science dedicated to advancing knowledge on the effect of natural product drugs, especially crude drugs, on humans.

WHY DO TRADITIONAL MEDICINES WORK?

Like all organisms, plants produce chemicals (or secondary metabolites) to interact with their environment. The evolution of organisms has resulted in large chemical diversity: the 1999 *Dictionary of Natural Products* lists 139,000 entries. The three major groups of medicinal compounds in plants are phenolics, terpenoids, and alkaloids: the latter group contains the largest number of medicines and, as a consequence, has been the major focus in screening for drug development.

Plant families tend to have the same type of metabolites, and their traditional use is similar. Taxonomists identify plant populations using these differences in secondary metabolites. The different species of *Echinacea*, for example, can be distinguished by analysis of the alkylamides found in their roots through high-pressure liquid chromatography. Purple Coneflower (*Echinacea angustifolia* DC., Asteraceae) is an important member of this group. This perennial herb is indigenous to the Great Plains of North America, and Indigenous Peoples use it as a treatment for sore throat and toothache, cold and flu, wound healing, and as a tonic. *Echinacea* products, derived largely from cultivation, are now popular worldwide as a cold and flu remedy, and are used by allopathic doctors for wound healing and treatment of systemic candidiasis.

ARE THESE MEDICINES RELIABLE?

Consumers of traditional medicines often complain of variable efficacy. Since most traditional medicines contain a mixture of elements rather than a single component, the variability may be the result of inconsistent ratios of ingredients. Or it may be the consequence of collecting plants from a location with different nutrients, a lack or excess of water, a lack or excess of light, too much predation, or any of a wide range of stressors. This link between efficacy and environment explains the strong emphasis in traditional medicine on the importance of time, place, and method of collection to maximize the effectiveness of treatments. Phytochemical analyses have shown levels of metabolites vary depending on a plant's age and its environmental stresses.

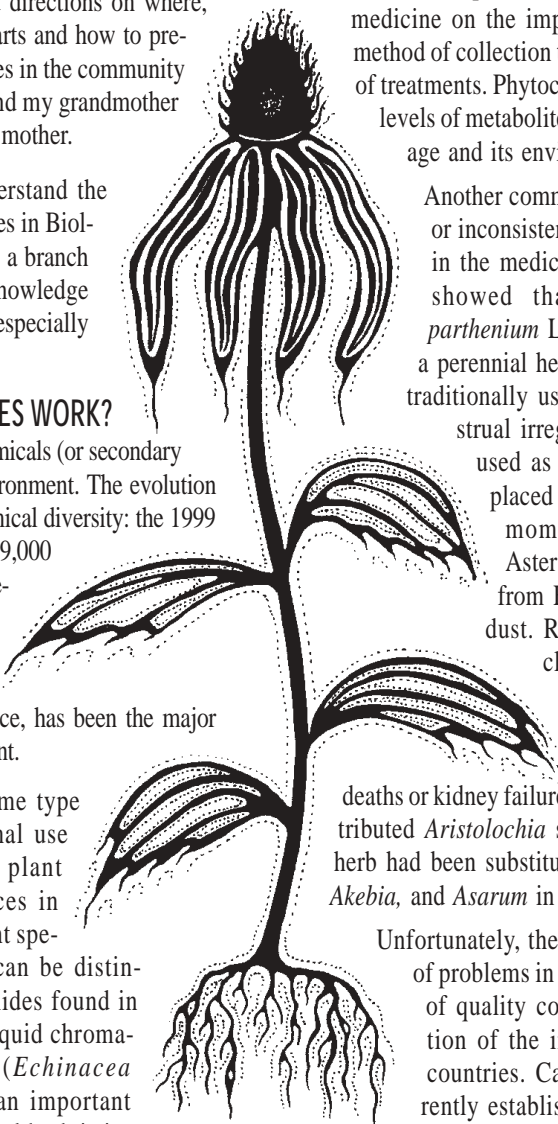
Another common problem is the unreliable or inconsistent quantity of a specific plant in the medicine. Studies from the 1980s showed that Feverfew (*Tanacetum parthenium* L. Schultz.-Bip., Asteraceae), a perennial herb indigenous to Europe and traditionally used to treat headaches, menstrual irregularity, and fever, and now used as a migraine remedy, was replaced in some medicines with Chamomile (*Chamomilla* spp., Asteraceae, another common herb from Europe), and even with sawdust. Recently some countries, including Canada, advised consumers against the use of products containing aristolochic acid because of

deaths or kidney failure from taking the globally distributed *Aristolochia* spp. (Aristolochiaceae). The herb had been substituted for *Stephania*, *Clematis*, *Akebia*, and *Asarum* in formulations.

Unfortunately, these are not isolated examples of problems in the herbal industry. This lack of quality control has led to the regulation of the industry in some developed countries. Canada, for example, is currently establishing regulations for natural health products, including herbals, botanicals, vitamins, and minerals, in response to consumer concerns about the safety and efficacy of health products.

WHY THE RENEWED INTEREST IN TRADITIONAL MEDICINES?

AIDS, lung cancer, and diabetes, all considered lifestyle diseases, are steadily increasing worldwide. AIDS is a pan-



Purple Coneflower
(Art by Christi
Belcourt)

Plant ¹	Traditional Use ²	Symptom	Plant Chemical
Catharanthus roseus (Rosy Periwinkle)	Madagascar: Asthma, Cancer, Catarrh, Ceguera, Cold, Depurative, Diabetes, Hyperglycemia, Hypertension, Laryngitis, Oliguria, Ophthalmia, Sore Throat, Toothache, Tuberculosis, Tumour	Hodgkin's Leukaemia	Vinblastine Vincristine
Chondrodendron tomentosum (Curaré)	Amazonian rainforest: Bruises, Diuretic, Dropsy, Emmenagogue, Febrifuge, Madness, Poison (arrow)	Skeletal muscle relaxant	Tubocuarine
Cinchona ledgeriana (Quinine)	Amazonian rainforest: Panacea	Anti-malarial	Quinine
Digitalis purpurea (Foxglove)	Europe: Asthma, Edema, Fever, Insanity, Neuralgia, Palpitations, Tumour (Abdomen)	Strengthen heartbeat	Digoxin
Hyoscyamus niger (Henbane)	Eurasia: Asthma, Cough, Narcotic, Sedative, Rheumatism	Motion sickness	Scopolamine
Pilocarpus jaborand (Jaborandi)	Brazil: Antidote (Atropine), Antidote (Belladonna), Baldness, Bright's Disease, Diaphoretic, Diuretic, Dropsy, Emetic, Febrifuge, Glaucoma, Lactagogue, Retinitis, Rheumatism	Glaucoma	Pilocarpine
Podophyllum peltatum (Mayapple)	Northeastern America (deciduous forest): Vermifuge, Dermatic (warts), Tumour (skin)	Testicular cancer, Small-cell lung cancer, Chorionic carcinomas, Kaposi's sarcoma, Lymphomas, Malignant melanomas	Podophyllotoxin
Taxus brevifolia (Pacific yew)	Northwest North America (coastal forest): Analgesic, Cancer, Diaphoretic, Dermatologic, Pulmonary, Stomachic, Tonic	Ovarian cancer	Taxol

Table 1
Examples of effective drugs extracted from medicinal plants.

¹ Compounds are now generally extracted from cultivated species or as in the case of taxol from a relative of the Pacific Yew.

² Country of origin is identified but most of the plants are now cultivated worldwide.

American ginseng (*Panax quinquefolius* L., Araliaceae). Endangered in its natural range of the deciduous forests in eastern North America, this perennial herb was used by its Indigenous Peoples to treat asthma, boils, convulsions, cough, cramps, cuts, difficult labour, earache, fevers, infertility, headaches, rheumatism, stomach-ache, worms, and as a tonic. It is currently in clinical trials for diabetes treatment at the University of Toronto, Canada. (Photo by Henry Goulet, 2001)

demically affecting huge populations in Africa, and diabetes, unheard of in the Aboriginal population in Canada prior to the 1940s, is now considered of epidemic proportions within this community. Traditional medicine is playing an important role in drug discovery to fight these and other diseases.

A research program initiated over 40 years ago by the US National Cancer Institute (NCI) is screening medicinal plants and generally all biota for cancer and AIDS cures. There are between 10–100 million organisms worldwide: approximately 250,000 species are plants of which 25–50% have traditionally been used for medicinal purposes. There have been some successes in the search for these cures. Table 1 illustrates examples of effective drugs extracted from medicinal plants. Clinical trials, which form the last phase of drug development, are now underway with a number of compounds from the NCI research.

Advances are also being made in other research. For example, American ginseng (*Panax quinquefolius* L., Araliaceae) is currently in clinical trials for diabetes treatment at the University of Toronto, Canada. Endangered in its natural range of the deciduous forests in eastern North America but now an important Canadian and American cash crop, this perennial herb was used by its Indigenous Peoples to treat asthma, boils, convulsions, cough, cramps, cuts, difficult labour, earache, fevers, infertility, headaches, rheumatism, stomach-ache, worms, and as a tonic.

Traditional medicines, including those from Traditional Chinese Medicine and the traditional medicine of the Indigenous Peoples of North America, are taken to maintain health, whereas Western medicine is used for the treatment of disease. Until the beginning of the twentieth century, traditional medicine was part of conventional medical practice. However, in the developed nations, it has largely been replaced today by the use of single entity synthetic drugs to treat disease. Recent surveys in Canada and the USA have shown that people, largely the baby-boomers, have renewed interest in preventative measures to ensure their own health. Traditional medicine is still the primary form of health care for 80% of the world's population who are largely from the developing nations. In the developed nations, we are really rediscovering what was lost a generation ago.

