

HerbalGram Timeline: 1993–2003 • New ABC Advisory Board Members
Herb Profile: Kesum • Mark Blumenthal Named 'Person of the Year'

HERBALGRAM

CELEBRATING 40 YEARS

The Journal of the American Botanical Council

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HERB MARKET REPORT



The
Mushroom
Moment



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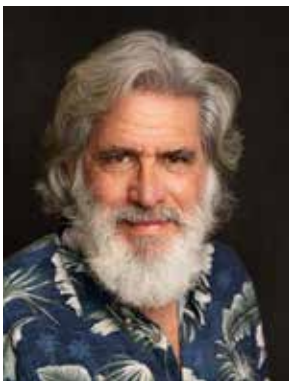
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dear reader

In the previous issue, we highlighted two significant ABC milestones: the 40th anniversary of *HerbalGram* and the kick-off of our HerbalGram40 Project and Fund community engagement and strategic planning process. Issue 138 also included a seven-page Dear Reader article with my reflections on the extensive history of this publication. Our sincere thanks to the ABC members and *HerbalGram* readers who have told us they appreciated that expanded column. We also offer profound gratitude to the many ABC members who contributed to Phase 1 of the HerbalGram40 Project and Fund in 2023. We invite all our members and other stakeholders to support this historic process of re-envisioning ABC's mission and role as

we move forward to serve the current and future needs of the international medicinal plant community.

ABC also recognizes another milestone: our 35th anniversary, which occurred on November 1, 2023. For 35 years, ABC has nurtured and curated our flagship publication into the unique magazine/journal hybrid that you are reading today, and we have grown in many directions.

In this issue, we continue to explore the history of *HerbalGram* in acknowledgement of our 40th anniversary. This issue contains Part 2 of our four-part *HerbalGram* timeline series, with a review of the articles and subjects covered in the journal's second decade (1993–2003). This should be of interest to those who were not part of the herbal community 20 to 30 years ago, when these articles were published. Perhaps of particular interest are articles on the challenging legal and regulatory situation leading up to and after the passage of the Dietary Supplement Health and Education Act of 1994 (DSHEA), which will reach its 30th anniversary in October 2024.

This issue also includes our latest Herb Market Report, covering US retail sales of herbal dietary supplements in 2022. We have published these annual reports for more than 15 years, and *HerbalGram* Managing Editor Tyler Smith has co-written them since 2014. We are grateful for the collaboration with our friends at *Nutrition Business Journal* (NBJ) and the market research firm SPINS. The authors have analyzed trends and reviewed some of the key clinical literature supporting (or not) consumer and professional interest in some of the top-selling herbal dietary supplements in the United States in 2022. Although total sales of herbal supplements increased sharply in 2020 and 2021, fueled by the COVID-19 pandemic, sales in 2022 decreased for the first time since 2003. Our gratitude to the co-authors, *HerbalGram* Associate Editor Hannah Bauman, SPINS' Haleigh Resetar, and NBJ's Erika Craft, for collaborating on this report.

A tip of the hat to our friend, ethnobotanist and author Mark Plotkin, a longtime member of the ABC Advisory Board, for his article on the growth of the fungi phenomenon in North America and worldwide. Mark is well known to *HerbalGram* readers, not only for his ethnobotanical writings outside this publication but also for his articles on the ethnobotany of warfare in issue 101 and the ethnobotany of wine in issue 129. He initially wrote the fungi feature for publication in *The New York Times* during the spring of 2023, but after reviewing it and sitting on it for several months, the *Times* chose not to publish it. The *Times*' loss is *HerbalGram*'s gain, and we thank Mark for sharing it with our readers.

We also offer our continued gratitude to Marisa Williams and Aaron Jenks of Traditional Medicinals for their article on the Asian medicinal plant kesum as part of *HerbalGram*'s series of Herb Profiles.

We welcome 13 new ABC Advisory Board members, many of whom we've known for years as colleagues and peer reviewers of articles in *HerbalGram*, HerbClip, and other ABC publications. These new members bring expertise in scientific fields related to the study of medicinal plants, including Ayurvedic and Chinese traditional medicine, women's health, supplement safety and quality, ethnopharmacology, natural product development, pharmacognosy, traditional African medicinal plants, regulatory affairs, and more.

In closing, I lamentably report the passing of two dear friends and mentors: Ara DerMarderosian, a professor of pharmacognosy at the former Philadelphia College of Pharmacy and Science (the nation's first school of pharmacy, established in 1821), and E. John Staba, a professor at the University of Minnesota. I met both in the late 1970s thanks to the late Paul Lee, who conceived of and directed the first Herb Trade Association Herb Symposia at the University of California, Santa Cruz in 1977 and 1978. Ara's obituary is in this issue, and John's will be in a future issue. Our thanks to longtime friend and ABC Advisory Board member John Beutler, who received his PhD from Ara, for his tribute to Ara. We also note the passing of cannabis expert Raphael Mechoulam and former United Nations Ambassador Bill Richardson, one of the first members of the US House of Representatives to sponsor rational dietary supplement legislation.

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36 The Mushroom Moment

By Mark J. Plotkin, PhD

Mushrooms and other fungal ingredients are becoming increasingly more visible in scientific literature, popular media, and the consumer market. The public fascination with fungi has led to more reporting and clinical trials on both psychedelic “magic mushrooms” and non-psychoactive medicinal species. New species continue to be discovered, including a *Psilocybe* species named after renowned mycologist Paul Stamets. Scientific research on fungi as both food and medicine has barely scratched the surface of the possibilities that fungi contain, and guest contributor Mark J. Plotkin, PhD, is optimistic about the future uses that science will find.

Clockwise from top left: Beech mushroom (*Lyophyllum shimeji*), Trumpet mushroom (*Pleurotus eryngii*), Maitake mushroom (*Grifola frondosa*), and Lion's mane mushroom (*Hericium erinaceus*).
Photo ©2024 Matthew Magruder

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40 Years of *HerbalGram*

Part 2: The Second Decade (1993–2003)

By ABC Staff

As part of the American Botanical Council's (ABC's) year-long celebration of the 40th anniversary of its flagship publication *HerbalGram*, ABC staff is exploring the magazine's four decades in a four-part timeline series. In its second decade in print, *HerbalGram* covered the landmark Dietary Supplement Health and Education Act of 1994 (DSHEA), ABC events such as continuing education ethnobotanical Amazon rainforest ecotours, and sales trends in the US herb and tea markets. Changes in *HerbalGram* and the organization also are cataloged, including the evolution of ABC's website and online services, the expansion of the journal to 80 pages, and more.

52 US Sales of Herbal Supplements Decline Slightly in 2022

By Tyler Smith, Hannah Bauman, Haleigh Resetar, and Erika Craft

Retail sales of herbal dietary supplements in the United States totaled an estimated \$12.121 billion in 2022 — a 1.9% decrease from 2021. This the first time since 2003 that annual sales of herbal supplements have declined. The slight drop in sales in 2022 reflects an expected normalization of consumer spending on herbal supplements after two years of record-breaking annual sales growth in 2020 and 2021 during the COVID-19 pandemic. Products that experienced significant sales growth during the first two years of the pandemic generally continued to decline in 2022, including sales of some immune ingredients and herbal products that were popular on social media platforms. In 2022, consumers sought out specific ingredients such as spirulina that went viral online in green beverages and continued to prioritize supplements marketed for digestive health and energy support.

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Kesum

Persicaria minor

(syn. *Polygonum minus*)

Family: Polygonaceae

Kesum
Persicaria minor
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INTRODUCTION

Kesum (*Persicaria minor* syn. *Polygonum minus*, Polygonaceae) is used widely as a medicine, food additive, and food flavoring in various cuisines.¹ It is an aromatic herb that grows commonly in Malaysia, Thailand, Vietnam, parts of Indonesia, and surrounding areas, and while it is native there, the natural range of this species is much larger and includes most of Europe and Asia. The species has now spread and is naturalized in many temperate and tropical areas outside its native range, including parts of North America and South America.²

Kesum typically grows in moist areas, from cool highlands to wet lowlands, preferring damp habitats such as waterways and ditches.³ It is a low-growing, creeping plant with slender green stems, occasionally growing to a height of 1-1.5 m¹ but often much shorter, depending upon habitat and growth environment.⁴ In Malaysia, it grows from 30-75 cm tall. The leaves grow alternately along the stem about 9 mm apart and are long and tapering; the blades are green (2-7 cm long and 0.3-2 cm wide). The tiny flowers are pink to white (2.5 x 2.5 mm) and grow on a spike-like inflorescence that grows erect from 1.5-5 cm high.⁵

Kesum is also known as pygmy smart weed,⁶ small water pepper, least water pepper, small persicaria, and swamp willow weed,⁷ although it is beginning to be more commonly known by its Malay name, *kesum*. It has many other common names across Southeast and South Asia including *phakphai* (also spelled *phak pai*) in Thailand and *Chakhong-machain* in Manipur, India. In Malaysia, kesum is also called *laksa* leaf due to the ubiquity of its use in the traditional Malaysian spicy noodle dish laksa.¹ According to the *American Herbal Products Association's Herbs of Commerce*, 3rd edition (2023), kesum's standard common name (SCN) is *Persicaria minor*.⁸

Persicaria minor is in the flowering plant family Polygonaceae, which is known in North America as the buckwheat family and elsewhere as the knotweed or smartweed family. This family contains around 1,200 species and 48 genera,⁹ including *Persicaria*, a genus of herbaceous annuals and perennials with alternate leaves. The stipules at the base of the leaves form an ocrea (or ochrea), a fibrous sheath surrounding the stem at each node. The ocrea is a distinctive morphological feature of the family Polygonaceae. In the genus *Persicaria*, the ocrea is leathery or papery and brown to reddish. Multiple flowers

grow on inflorescences that in many species are paniculate and once fertilized grow into a fruit type called an achene (a small, one-seeded fruit).¹⁰ *Persicaria* contains 100-131 species^{2,10} and is closely related to the genus *Polygonum* (both of the subfamily Polygonoideae), the genus in which kesum was originally described. Distribution of *Persicaria* is cosmopolitan, occurring nearly worldwide.²

While primarily used as a comestible in Malaysian and other Southeast Asian cuisines, kesum is also valued for its medicinal properties. The leaves and aerial parts are used fresh or cooked and taken internally for digestive disorders and body aches and pains. Kesum's value as a food and flavoring agent is due largely to its distinctive flavor profile, the result of its complex array of volatile oils and flavonoids. The complex and aromatic phytochemical constituents of kesum may also be largely responsible for its medicinal use and efficacy and are associated with its antioxidant properties.^{1,11}

In Malaysia, kesum is cultivated extensively for sale as a fresh herb in markets across the country and for export. Malaysian cultivation, some of which is government-sponsored, appears to be primarily responsible for the presence of kesum on global markets.¹¹ Beyond kesum's limited international trade for culinary use in certain Asian cuisines, the species is not widely sold or available as a medicinal dietary supplement ingredient or botanical plant drug outside of Southeast Asia.

HISTORY AND CULTURAL SIGNIFICANCE

Kesum was first described as a new species, *Polygonum minus*, by William Hudson (1730-1793), a British botanist, apothecary, and Fellow of the Royal Society of London, in his work *Flora Anglica* in 1762.¹² The name *Polygonum* stems from the Greek *poly* (meaning "many") and *gonu* (meaning

“knees” or “joints”) or, probably more accurately, *gonos* (meaning “offspring” or “seeds”), according to the Flora of North America editorial committee.¹³ The specific epithet *minus* is Latin for “small,” “diminutive,” or “less.” In his 1852 work *Seznam Rostlin Květeny České (Inventory of Czech Flora)*, Bohemian (now Czech Republic) botanist Philipp (Filip) Maximilian Opiz (1787–1858) placed the species in the genus *Persicaria*, and kesum has since been classified taxonomically as *Persicaria minor*.¹⁴ *Persicaria* comes from the Latin words *persica* (meaning “peach”) and *-aria* (relating to leaves), alluding to kesum’s peach (*Prunus persica*, Rosaceae) tree-like leaves.¹⁰ The specific epithet *minor* is Latin and similar in definition to *minus*; it was probably given to this species due to its smaller or slighter morphology compared with other members of the genus *Persicaria*.

Persicaria minor is often synonymized with *Persicaria maculosa* (commonly known as lady’s thumb)⁸ in North American floras, and although not taxonomically conspecific, the two species are reported to hybridize in Europe.⁴ Historically in North America, the Cherokee, Chippewa, and Iroquois used *P. maculosa* both internally as a gastrointestinal aid and externally as a dermatological aid. Other internal and topical uses are reported.¹⁵ Interestingly, *P. maculosa* in North America and *P. minor* in Southeast Asia have similar traditional therapeutic uses.

Although kesum is commonly found growing in moist areas throughout its native range in Southeast Asia, it is now broadly cultivated in Malaysia and potentially elsewhere to meet growing commercial demand for its use as food and medicine. Its cultural significance in Southeast Asia as an important ingredient in many dishes, from salads to spicy noodle soups, is reinforced by its widespread traditional medicinal uses in that region. In the traditional medicine practices of Malaysia and Southeast Asia, kesum is used primarily as an internal cleanser or digestive aid that helps eliminate flatulence. Kesum’s cultural value and high importance stem largely from its distinctive, pleasant, and highly aromatic odor derived from a complex mixture of essential oils, flavonoids, and other volatile constituents, and described as a blend of oregano (*Origanum vulgare*, Lamiaceae) and basil (*Ocimum basilicum*, Lamiaceae), with a hint of citrus (*Citrus* spp., Rutaceae) and other notes.¹¹

In Malaysian cuisine, not only is kesum a primary ingredient in the spicy noodle soup laksa, but it is also frequently used finely sliced as a fresh ingredient in *ulam* (a type of salad) along with other vegetables. Its distinctive flavor also forms the base of the rice (*Oryza sativa*, Poaceae) dish *nasi ulam*, and it is the principal ingredient in the Malaysian mango (*Mangifera indica*, Anacardiaceae) salad *kerabu*.^{1,11} The names kesum and laksa leaves are also applied to *P. odorata*, another *Persicaria* species native only to Southeast Asia and more commonly known as Vietnamese mint or Vietnamese coriander. *Persicaria odorata* is known in Thailand and Vietnam by many of the same common names as *P. minor*.¹⁶ In areas where both *P. odorata* and *P. minor* occur, they appear to be used somewhat interchangeably in local cuisines and can be considered to belong to the same Medicinal Plant Complex, a group of plants sharing common names, medicinal uses, and organoleptic properties.^{17,18}

Fresh kesum leaves are traditionally decocted and taken to allay flatulence, stomach pains, constipation, and indigestion.^{1,11} They are added to food, frequently fish, to improve

digestive health and reduce flatus. Kesum is also reported to relieve ulcers and improve vaginal health. Traditionally, kesum is given to mothers internally after birth for “internal cleansing” and to improve postpartum health.¹¹ Beneficial properties of kesum for the skin are known widely in traditional Malaysian herbalism, and it is used externally in various cosmetic applications and postpartum for stretch marks. For this latter use, the fresh leaves are ground into a paste that is applied to the skin. Other botanical additives to this kesum-based, stretch-mark paste are rice, turmeric (*Curcuma longa*, Zingiberaceae), and occasionally tamarind (*Tamarindus indica*, Fabaceae) juice.¹¹ Kesum is considered a traditional topical medicine for dandruff¹⁹ and other conditions relating to the skin and scalp, and is also used in aromatherapy and the perfume industry. In Malaysia, it is sold as a component of spice mixtures and included in ready-to-drink beverages that support digestive health.¹¹

CURRENT AUTHORIZED USES IN COSMETICS, FOODS, AND MEDICINES

A quality, safety, and therapeutic monograph for kesum leaves and twigs appears in the 2015 edition of *Malaysian Herbal Monograph*, published by the Institute for Medical Research under the Malaysian Ministry of Health.⁵ This is the only known governmental compendial monograph describing kesum. Malaysia may also be among the few countries where kesum herbal medicinal products have had marketing authorizations granted thus far. At the time of this writing (summer 2023), a total of 19 kesum medicinal products (eight with *Persicaria minor* and 11 with *Polygonum minus* as an active ingredient) were listed in the National Pharmaceutical Regulatory Agency’s licensed pharmaceutical products database. The marketing authorization holder for 16 of the 19 products is Biotropics Malaysia Berhad. A Kuala Lumpur, Malaysia-based company, MB Nutraceuticals Sdn. Bhd., holds the marketing authorizations for two of the kesum-containing medicinal products, and a manufacturer in Shah Alam, Malaysia, Phytes Biotek Sdn. Bhd., is the holder of the third product. There were also registered kesum cosmetic products, two of them held by VNI Scientific Sdn. Bhd. of Senawang, Malaysia.²⁰

In the United States, kesum (either listed as *Persicaria minor* or its synonym *Polygonum minus*) does not appear in most online databases of the US Food and Drug Administration (FDA), such as the Dietary Supplement Ingredient Directory database, Generally Recognized as Safe (GRAS) Notices database, New Dietary Ingredient Notifications database, and the Select Committee on GRAS Substances (SCOGS) database. The US National Institutes of Health’s (NIH’s) Dietary Supplement Label Database also lists no kesum products.²¹ The FDA’s Global Substance Registration System database, however, includes one listing for “*Persicaria minor* whole” and provides a unique ingredient identifier (UNII) UIS02CZD1V.²² The company Biotropics Malaysia has made a self-determination of GRAS for its branded ingredient BioKesum®.

In Canada, *Persicaria minor* (whole plant, fresh or dry) is listed as a medicinal ingredient for use in licensed natural health products (NHPs)²³; however, no NHPs are yet listed to contain *P. minor* as an ingredient in the Licensed Natural Health Products Database.²⁴

In the European Union (EU), *P. minor* does not appear in the EU Novel Food status Catalogue,²⁵ and it is not found on the websites of the European Food Safety Authority or European Medicines Agency. For use in cosmetic products in the EU, the defined ingredient “*Persicaria Minor Leaf/Stem Extract*” is authorized for antioxidant function.²⁶

MODERN RESEARCH

Constituents and Pharmacological Effects

Kesum leaves are valued for their high essential oil content and aromatic properties.^{1,27} From the limited number of phytochemical studies, it is known that kesum leaves abound in aliphatic aldehydes (e.g., decanal and dodecanal).^{5,27-29} Other compounds in the plant include aliphatic alcohols, sesquiterpenes (e.g., β -caryophyllene),³⁰ monoterpenes,⁵ and flavonoids (e.g., flavanols, myricetin, and quercetin).¹ The predominant compounds in the essential oil are aliphatic aldehydes (ca. 60-75%), aliphatic alcohols (ca. 2-9%), sesquiterpenoids (e.g., α -caryophyllene and β -farnesene), and monoterpenoids.³¹ Polygonumins A, a polyoxygenated compound, also has been isolated from the stem of the plant.³²

Phytochemical assay analyses and in vitro studies performed on kesum leaves have demonstrated antifungal,¹⁹ antioxidant,^{1,5,33-36} and antiviral properties.^{1,29,37} Gastroprotective pharmacological activity also has been reported in in vivo (rat) studies.^{1,5,38}

Traditionally, kesum has been used for dandruff. A preclinical study evaluated the in vitro activities of shampoo formulas using various amounts of an ethanol extract of kesum leaves to assess the effect on *Pityrosporum ovale*, a fungus associated with dandruff. The concentrations of the ethanol extract in the shampoo formulas were 0%, 5%, 10%, and 15%. The formulations also contained other additives. The 15% kesum extract-containing shampoo showed the highest antifungal activity, with an inhibitory diameter zone of 2.61 cm.¹⁹

The total phenolic content of aqueous and ethanol extracts of kesum leaves were reported at 55.5 mg/g and 207 mg/g, respectively.^{5,35} One study evaluated Malaysian kesum plants and their antioxidant properties by using a DPPH free radical scavenging activity model. According to the study, an ethanol extract of kesum had higher free radical scavenging activity compared to an aqueous extract of kesum (89.5 +/- 1.07% and 81.88 +/- 0.98%, respectively), which had a similar finding of gallic acid, a standard for phenolic content studies, at 88.8 +/- 0.85%.³⁵ In a separate study, a freeze-dried leaf aqueous extract of kesum (200 μ g/mL) was evaluated for antioxidant activity using three different bioassays. The researchers reported the lipid peroxidation inhibitory activity as 98.3 +/- 0.4%, superoxide scavenging activity as 77.9 +/- 1%, and DPPH radical scavenging activity as 98.8 +/- 0.5%.³⁶

Malaysian vegetable extracts were evaluated for antioxidant, phenolic, and flavonoid contents. Of the nine vegetables studied, a boiled aqueous extract of kesum leaves showed the highest

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total flavonoid content at 6.28 mg/g fresh weight. Additionally, high phenolic content was reported at 10.92 mg/g dry weight.³³ Fresh plant extracts of kesum, ginger (*Zingiber officinale*, Zingiberaceae), and turmeric were compared for total phenolic content. Kesum extract was reported to have the highest content (165.34 mg gallic acid equivalent [GAE]/100 g extract) followed by ginger extract (101.56 mg GAE/100 g extract), and turmeric extract (67.89 mg GAE/100 g extract).³⁴

A paper from 1996³⁷ reported antiviral activity, which has been cited in review articles^{1,29} as one of the pharmacological properties of kesum. An in vitro study screened 61 plants from Malaysia for potential antiviral activity. An ethanol extract of kesum demonstrated antiviral activity, exhibiting stronger activity against herpes simplex virus type 1 (minimal inhibitory concentration [MIC] = 0.01 mg/mL) with lesser activity against another virus, vesicular stomatitis virus (MIC = 0.02 mg/mL).³⁷

Aqueous leaf extracts of kesum (250 mg/kg and 500 mg/kg) demonstrated gastroprotective activity in an ethanol-induced gastric ulcer animal (rat) model. A single dose of the aqueous extracts decreased the size of the ulcerated area.^{1,5,38}

A branded commercial aqueous extract of kesum leaves, BioKesum was evaluated in both in vitro and in vivo settings for anti-inflammatory activities. An ethanol extract of kesum aerial parts inhibited the 5-lipoxygenase (5-LOX) and cyclooxygenase-1 (COX-1) enzymes, which are main enzymes in the pro-inflammatory process.³⁹ Additional findings of BioKesum (at doses of 100 mg/kg body weight and 300 mg/kg body weight) demonstrated anti-inflammatory activity in a carrageenan-induced rat paw edema model.³⁹

Toxicity

Long-term traditional and culinary uses are established for kesum in Malaysia.¹¹ However, toxicity studies are limited and not well-established for kesum.⁵ In an acute animal (rat) study, an aqueous leaf extract of 5 g/kg for 14 days did not show clinical toxicity signs based on histological, hematological, and serum biochemical parameters or behavioral changes upon examination.³⁸ The compendial *Malaysian Herbal Monograph*, 2015 edition, states that for kesum use in humans, clinical safety studies, adverse effects, and contraindications have not yet been established.⁵

Human Clinical Studies

To date, clinical studies on kesum have been carried out with an aqueous leaf extract that has focused on mild cognitive support,⁴⁰ sexual wellbeing,⁴¹ and topical facial support for wrinkles.⁴² BioKesum, the branded extract, has been evaluated in both monoherbal and polyherbal preparations. One example of a polyherbal preparation includes SuperUlam (Biotropics Malaysia), which is a proprietary blend that contains kesum leaf extract as one of the herbal ingredients and has been evaluated for mood and cognitive support.⁴³

A preliminary, randomized, double-blind, placebo-controlled study evaluated effects related to mild cognitive impairment. Thirty participants completed the study (BioKesum, n = 15; placebo, n = 15). A subgroup of 15 participants (BioKesum, n = 8; placebo, n = 7) participated in brain activation assessments. The investigational product group participants took one capsule of BioKesum (250-mg capsule of aqueous extract, which

contained quercetin-3-O-glucuronide [not less than 0.45%], quercitrin [not less than 0.15%], and a total phenolic content not less than 100 mg GAE/g DE [dry extract]), and the placebo group received one placebo capsule (280-mg capsule, maltodextrin) twice daily for six months.

Participants were evaluated during three visits throughout the six-month study period. The participants' mood (self-reporting questionnaire) and cognitive and neuropsychological tests (Mini-Mental State Examination, Digit Span, Rey auditory verbal learning test, Digit Symbol, visual reproduction) were used to evaluate cognitive function. These tests, which the authors considered primary outcomes, were measured at baseline, three months, and six months. The subgroup, at both baseline and six months, participated in cognitive functioning tests at the same time as functional Magnetic Resonance Imaging (fMRI) to evaluate brain activity, which was considered a secondary outcome of the study. Biochemical blood markers also were assessed. Results at the end of the preliminary study reported improvements in the supplementation treatment group in visuospatial memory, triglyceride levels, and brain-derived neurotrophic factor levels, as well as improvements in some mood states of anger, tension, and confusion. According to the authors, no adverse events were reported. The authors noted the need for more research, given the small number of participants and that a self-reporting questionnaire was used for one of the primary outcomes measures.⁴⁰

A 12-week, randomized, double-blind, placebo-controlled study assessed the sexual wellbeing effects of a kesum-containing product in 40-65-year-old males.⁴¹ The treatment group (n = 12) received Physta® (Biotropics Malaysia), an investigational product that contains 200 mg of a proprietary freeze-dried water extract of tongkat ali (*Eurycoma longifolia*, Simaroubaceae) (drug-to-extract ratio of 25:1) and 100 mg of an aqueous extract of kesum leaf (drug-to-extract ratio of 10:1), and were instructed to take one tablet per day. The control group (n = 14) received a placebo tablet (α -lactose-monohydrate, microcrystalline cellulose, and magnesium stearate). Improvements were measured by sexual intercourse attempt diary, an erection hardness scale, sexual health inventory, and an aging male symptom scale. All measurements improved significantly in the small number of study participants in the investigational product group compared to placebo. The 12-week study also included liver and kidney function tests, and the authors reported no significant abnormalities.^{41,44}

In a two-month, placebo-controlled study, a topical cream gel, which contained kesum leaf aqueous extract (known at the time of publication as Lineminus™, a previous name of BioKesum) and other cosmetic ingredients used in skin products, was compared to placebo to evaluate the product's anti-wrinkle properties. A total of 23 healthy female study participants between 48 and 60 years old were provided a treatment topical or placebo topical and instructed to apply twice daily on one side of the face for up to two months in a comparative design. Self-assessment questionnaires, dermatological evaluations by a dermatologist, and an imprint casting skin replica analysis were conducted at one month and two months. The authors reported overall reduction of wrinkle activity of the skin with the active cream, which was well-tolerated through the study with no adverse effects reported.⁴²

ADULTERATION AND SUBSTITUTION

The 2015 edition of *Malaysian Herbal Monograph* for kesum provides botanical identification methods using plant morphology (macroscopic and microscopic), thin layer chromatography (TLC), and high-performance liquid chromatography (HPLC).⁵ In other areas, the species *P. hydropiper* and *P. odorata* may also refer to laksa leaf, one common name of *P. minor*.^{16,39}

SUSTAINABILITY AND FUTURE OUTLOOK

Persicaria minor is not subject to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)⁴⁵ nor has the species been assessed globally according to International Union for Conservation of Nature (IUCN) Red List categories and criteria. Wild populations of the species occur throughout Europe and much of Asia. Competent authorities of some countries have assessed its conservation status using IUCN Red List criteria. *Persicaria minor* is classified as endangered (EN) in Luxembourg,⁴⁶ near threatened (NT) in Switzerland⁴⁷ and Tajikistan,⁴⁸ vulnerable (VU) in Great Britain,^{49,50} least concern (LC) in Austria,⁵¹ Denmark,⁵² and Ireland,⁵³ and data deficient (DD) in Sri Lanka.⁵⁴ Germany does not use IUCN Red List criteria and classifies *P. minor* as not endangered, similar to IUCN's LC status.⁵⁵ In the two main countries where *P. minor* is used medicinally, Malaysia and Indonesia, the species is not included in the Malaysia Red List, and Indonesia does not yet have a national Red List for vascular plants.

The focal point for production and use of *P. minor* is Malaysia, where governmental initiatives have supported research and development to promote its use.⁵⁶ Commercial cultivation also occurs in Malaysia.¹¹ Given how widespread this species is distributed globally and how few commercial products contain it outside of Southeast Asia, commercial trade does not appear to be a factor that would impact the species' survival at this time. Research into climate change adaptation is only beginning. To help inform a conservation strategy for this species, one study assessed genetic diversity of nearly 100 *P. minor* plants randomly collected from 11 populations in different regions of Iran. The study demonstrated high genetic diversity within and among populations of this species.⁵⁷ Genetic diversity studies of *P. minor* populations in other regions of the world will be important, especially if commercial trade and use of the species increase in the future. 📍

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HerbalGram Celebrates 40th Anniversary

ABC establishes the HerbalGram40 Project and Fund to grow its unique scientific research and educational mission

By ABC Staff

In September 2023, the American Botanical Council (ABC) announced the 40th anniversary of its acclaimed magazine/journal *HerbalGram*. As part of its observance of this milestone, ABC has created a yearlong project to enhance the organization's unique, international, nonprofit research and educational mission, publications, and programs: the HerbalGram40 Project and Fund.

The HerbalGram40 Project and Fund page on ABC's website invites comments and insights from ABC supporters not only to help celebrate the 40-year milestone but also to help identify enhancements to existing ABC programs and suggest possible new projects and programs relevant to the herbal community. Donations to fund the robust, continued growth of ABC and *HerbalGram* can also be made on this webpage. These donations are an important part of the nonprofit's ability to meet the growing demand and need for responsible, reliable, science-based herb and medicinal plant information.

HerbalGram was created in the 1980s by herb community veteran Mark Blumenthal, then the owner of an herb wholesale company in Austin, Texas, and Rob McCaleb, then the research director at Celestial Seasonings herbal tea company in Boulder, Colorado.

The first issue was an eight-page newsletter, then called "HERB NEWS/Herbalgram," printed in summer 1983. Articles in that issue announced the formation of two new herb organizations: the American Herbal Products Association (AHPA), which was founded the previous year in 1982 and is now the leading trade association that deals with herbs and medicinal plants, and the Herb Research Foundation, a nonprofit research and education organization. For its first five years, *HerbalGram* was the official publication of both organizations.

In November 1988, Blumenthal, along with renowned ethnobotanist James A. Duke, PhD (1929–2017), and acclaimed pharmacognosist Norman R. Farnsworth, PhD

(1930–2011), founded the nonprofit ABC to support the development of *HerbalGram* into a four-color, peer-reviewed publication. At that time, other than a few scientific journals, very little reliable information was available on herbs, medicinal plants, and their products in the market. Over the past 35 years, ABC has grown into an internationally respected organization, which has reached members in more than 80 countries, with numerous publications and programs.

In *HerbalGram* issue 138 (Summer 2023), Blumenthal's seven-page "Dear Reader" article documents the history of the publication. His personal and historical narrative recounts the evolution of *HerbalGram* and provides examples of ABC projects that resulted from seminal *HerbalGram* articles. These include ABC's translation and publication of *The Complete German Commission E Monographs: Therapeutic Guide to Herbal Medicines* in 1998, ABC's HerbClip summaries of clinical and other scientific research papers, the ABC-AHP-NCNPR Botanical Adulterants Prevention Program (BAPP), and many others.

In his Dear Reader article, Blumenthal also emphasizes that throughout *HerbalGram*'s history, one primary goal has been to produce accurate and reliable content. Accordingly, *HerbalGram* is peer reviewed by various experts in scientific fields related to herbs and medicinal plants, including ethnobotany, pharmacognosy, and more.

As part of the yearlong HerbalGram40 Project and Fund, ABC is reviewing the history of *HerbalGram* in a series of four timelines.

AMERICAN BOTANICAL COUNCIL

HERBALGRAM40

PROJECT & FUND

Support Trustworthy Herbal Education Now and in the Future

“The history of *HerbalGram*’s first 40 years of publication reflects much of the history and evolution of the modern herb and medicinal plant movement in the United States and beyond,” said Blumenthal. “Many of the articles in *HerbalGram* provided thought leadership for the emerging herb community in the areas of research, clinical practice, industry, and product development.

“Over the past few years,” Blumenthal continued, “numerous ABC members and various herb community colleagues have stated repeatedly how important it is for those of us who have many years of experience in the herb movement to write its history for the benefit of younger leaders of the herbal community and for future generations.”

In its earlier years, *HerbalGram* covered the growing concerns of an industry that did not have a rational regulatory system, published market sales data at a time when such information was difficult to obtain, and highlighted many other issues that would help determine the direction of the natural products movement.

Hundreds of authors, including some of the leading experts and thought leaders in the herb community, have contributed to *HerbalGram* during its history. Their contributions have been substantial and enormously appreciated. Many of these generous, talented people will be acknowledged during the HerbalGram40 year-long process. 📧

The HerbalGram40 Project and Fund: ABC Invites Feedback

ABC invites its members and friends to visit the HerbalGram40 Project and Fund page to leave comments, donate, and learn about this exciting yearlong project.

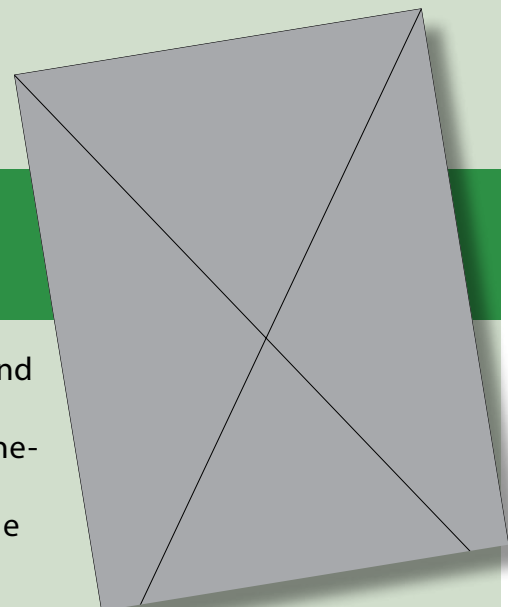
For more information, visit www.herbalgram.org/get-involved/herbalgram-40-project-and-fund/.



HerbalEGram ABC's Monthly eMagazine

Featuring timely, original articles and a review of the month's most important herbal happenings

- An ABC membership benefit published the second week of each month
- Exclusive excerpts from the latest herbal medicine-related books
- All previous issues going back 16+ years available on ABC's website at: <https://herbalgram.org/resources/herbalegram>



ABC Welcomes 13 New Advisory Board Members

By ABC Staff

The American Botanical Council (ABC) welcomes 13 new expert members to its advisory board. These new members will bring perspectives and experiences from numerous scientific fields related to the study of medicinal plants, including Ayurvedic medicine, botanicals for women's health, Chinese herbal medicine, dietary supplement safety and quality, ethnopharmacology, natural product development, pharmacognosy, traditional African medicinal plants, regulatory affairs, toxicology, and more. They join more than 130 current members of the ABC Advisory Board.

ABC Advisory Board members volunteer their time to peer review articles that appear in *HerbalGram*, *HerbalEGram*, *HerbClip*, and other peer-reviewed ABC publications. ABC management and *HerbalGram* editors seek feedback and advice from advisory board members on research questions, article ideas, ABC policies, and book reviews, among many other topics.

ABC Chief Science Officer Stefan Gafner, PhD, wrote: "I am deeply grateful to the 13 new ABC Advisory Board members for their willingness to serve on the advisory board and for investing their time to support and promote ABC's nonprofit research and educational mission with their expert advice. Having such a diverse range of expertise within our advisory board allows us to seek input on a wide array of topics. For me, as a scientist, one of my greatest joys and privileges at ABC is interacting with such highly qualified individuals, and I look forward to the input of our newest members."

Anna Rita Bilia, PhD

Bilia is the director of the postgraduate School of Hospital Pharmacy and a professor in the Department of Chemistry at the University of Florence in Italy. Bilia earned her PhD in chemical sciences at the University of Pisa and conducted postdoctoral studies on the isolation and characterization of bioactive molecules from medicinal plants.

She leads a research group at the University of Florence's Natural Products Lab, which focuses on improving biopharmaceutical properties of plant extracts and natural products; studying pharmaceutical and technological aspects of herbal drugs, herbal drug preparations, and herbal medicinal products; authentication, quality control, and stability testing of bioactive compounds; and isolation and structural determination of secondary constituents from plants.

She previously served as a member of the board of directors, vice president, and president of the Society for Medicinal Plant and Natural Product Research (GA). In 1997, she received the Claudio Redaelli award for outstanding young researchers in the field of phytochemistry from the Italian Society of Phytochemistry and, in 2002, she received the Egon-Stahl-Award in Silver from the GA.



Eric Brand, PhD

Brand is an associate professor of pharmacognosy at Taipei Medical University in Taiwan, an instructor of Chinese herbal pharmacognosy at the Acupuncture and Integrative Medicine College in Berkeley, California, and chief executive officer at Legendary Herbs, Inc. He earned his PhD under Professor Zhongzhen Zhao, PhD, who is also an ABC Advisory Board member, at Hong Kong Baptist University's School of Chinese Medicine.

Brand is an expert in the quality control and authentication of traditional Chinese medicinal plants and has published extensively in English about Chinese materia medica, analyses of plants including ginseng (*Panax* spp., Araliaceae), and textbook curricula for traditional Chinese medicine (TCM). Previously, he worked as the deputy general manager in the United States for Tong Ren Tang, the Chinese pharmaceutical company founded in 1669, and served as the chair for the US delegation for the International Organization for Standardization's (ISO's) technical committee for TCM.

He is currently a TCM advisor for the American Herbal Pharmacopoeia (AHP) and member of the Hong Kong Chinese Medicine Pharmacists Association. Brand authored "The Rise and Fall of Maca in China," an article detailing the boom and bust of the maca (*Lepidium meyenii*, Brassicaceae) market in China, in *HerbalGram* issue 111 (Fall 2016).

Alain Cuerrier, PhD

Cuerrier is an adjunct professor in the Department of Biological Sciences at the University of Montréal and a botanist at the Montréal Botanical Garden. He is an ethnobotanist with a research focus on biodiversity, climate change in the Canadian arctic, and plants used by First Nations peoples, particularly for diabetes management. Much of his research includes conducting field interviews to document and preserve traditional knowledge that previously was transmitted orally. His



research into antidiabetic medicinal plants of the Inuit and Cree nations of Canada addresses the high rate of diabetes among First Nations communities.

Cuerrier is also a translator and poet who has published multiple collections of poetry in French and English. His translation works include *Neiges* (Triptyque, 2006), a collection of poetry by author Carolyn Marie Souaid, and Johannes Reinke's *Philosophy of Botany* (University of Montréal Press, 2019), which he translated with Hildegund Janzing and Denis Barabé.

He previously was an associate editor for the Society of Ethnobiology, past president and treasurer of the International Society of Ethnobiology, past vice president and now treasurer of the Natural Health Product Research Society of Canada, and editorial consultant for the *Journal of Ethnobiology and Ethnomedicine* and *Ethnobotany Research and Applications*. He has authored or co-authored 12 books in his field and is the recipient of the 2023 Jacques-Rousseau Prize for multidisciplinary studies from Acfas (formerly known as the Association francophone pour le savoir).

Birgit M. Dietz, Dr. rer. nat., PharmD

Dietz is an adjunct research associate professor in the Department of Pharmaceutical Sciences at the University of Illinois-Chicago (UIC). She completed her doctoral studies under Professor Rudolf Bauer, Dr. rer. nat., at Heinrich Heine University in Düsseldorf, Germany, with a dissertation on the constituents of *Echinacea atrorubens* (Asteraceae).



At UIC, she teaches courses on drug metabolism, phytotherapy, and pharmacognosy for PharmD students and pharmacognosy students. She also has supervised undergraduate students, PharmD students, and postdoctoral fellows and served on examination committees for master's and doctoral theses. Her research interests include botanicals for women's health, such as hops (*Humulus lupulus*, Cannabaceae), black cohosh (*Actaea racemosa*, Ranunculaceae), and red clover (*Trifolium pratense*, Fabaceae), as well as estrogenic and chemopreventive properties of plants.

She has served as a reviewer for several journals, including *Phytomedicine*, *Journal of Ethnopharmacology*, *Planta Medica*, and *Journal of Natural Products*, and has co-authored more than 40 peer-reviewed publications.

Nigel Gericke, MD

Gericke is a physician, ethnobotanist, and ethnopharmacologist with expertise in traditional African medicinal plants, product development, and herbal medicines that affect

the central nervous system. Since 1995, he has worked for Dr. Gericke Consulting, a contract research organization that he founded and owns in Baden, Switzerland. The organization specializes in botanical discovery, research and development, and commercialization of herbal medicinal products.

Gericke is the co-founder and former medical and scientific director of HG&H Pharmaceuticals (Pty) Ltd., a phytomedicine manufacturer in Johannesburg, South Africa, where he led the development of Zembrin®, a clinically researched extract of the traditional South African plant kanna (*Sceletium tortuosum*, Aizoaceae). He has extensive experience with various phytomedicine businesses.

From 1987 to 1993, Gericke was a medical practitioner. He received his Bachelor of Medicine, Bachelor of Surgery (MBBCh) degree — the equivalent of a Doctor of Medicine (MD) degree in the United States — in the 1980s at the University of the Witwatersrand in Johannesburg, where he also completed Bachelor of Science degrees in botany and zoology in the 1970s.

Gericke is the author or co-author of two books — *People's Plants: A Guide to Useful Plants of Southern Africa* (Briza Publications, 2000) and *Medicinal Plants of South Africa* (Briza Publications, 2011) — four book chapters, and at least 35 research publications. He also is a reviewer for the *Journal of Ethnopharmacology* and has written or co-written articles for *HerbalGram*, including “Tree of Life: The Use of Marula Oil in Southern Africa” in issue 79 (Summer 2008) and “Ethnobotanical Records from a Corporate Expedition in South Africa in 1685” in issue 102 (Summer 2014).



Lal Hingorani, PhD

Since 1997, Hingorani has been the managing director of Pharamza Herbal Pvt. Ltd. (Anand, India), which produces botanical extracts with Verdure Science in the United States. He has extensive experience in the pharmaceutical and phytomedicine industry in India, having worked at Merind Ltd., Walter Bushnell Pvt Ltd., and Searle India Ltd. (now called RPG Life Sciences).

Hingorani received a PhD in chemistry from the Indian Institute of Technology in 1989 and completed a diploma in marketing management from St. Xavier's College in



1990, both in Mumbai. He has expertise in phytochemistry, analytical chemistry, and pharmacology and specializes in herbal product development, as well as pre-clinical and clinical pharmacokinetics of botanical ingredients, and safety and efficacy clinical trials of herbal supplements.

He is a member of numerous industry and Indian government advisory boards and currently serves as chairman of the Shellac and Forest Products Export Promotion Council (part of India's Ministry of Commerce and Industry). In 2022, Hingorani received an Herbal Industry Leader Award from the Society for Ethnopharmacology.

Hingorani has authored or co-authored more than 75 research articles, 50 conference proceedings, 10 conference papers, and two book chapters. He also co-authored the ABC-AHP-NCNPR Botanical Adulterants Prevention Program's (BAPP's) Botanical Adulterants Prevention Bulletin on saffron (*Crocus sativus*, Iridaceae) and saffron extracts, which was published in March 2022.

Amy Keller, PhD

Keller has worked since 2017 as a research scientist for the Rocky Mountain Regional Veterans Affairs Medical Center and as an assistant professor in the Division of Endocrinology, Metabolism and Diabetes at the University of Colorado (CU) School of Medicine in Aurora, Colorado. She currently focuses on the role of plant compounds, botanical supplements, and functional foods in supporting vascular health in people with diabetes.



She completed several postdoctoral fellowships, which focused on diabetes, at the CU School of Medicine and received her PhD in biology (plant sciences) from the City University of New York (CUNY) in 2011. For her thesis, she investigated the antidiabetic effects of two traditional Dominican medicinal plants: *Costus spicatus* (Costaceae) and *Momordica charantia* (Cucurbitaceae). She has two Bachelor of Arts degrees from CU Boulder, in Environmental, Population, and Organismic Biology and Russian.

Throughout her career, Keller has served in various editorial roles and has authored or co-authored at least 25 scientific journal articles. From 2011 to 2017, she was an HerbClip writer for ABC, and, from 2006 to 2017, she was an assistant editor for the quarterly newsletter of the American Society of Pharmacognosy (ASP). She is an editorial board member of the *Journal of Hypertension* and an ad hoc reviewer for multiple scientific journals, including the *The American Journal of Cardiology*, *Annals of Medicine*, *Antioxidants*, *Journal of Agricultural and Food Chemistry*, *Nutrients*, *Phytomedicine*, and *PLOS One*, among others.

She is also a pharmacognosy and natural products chemistry advisor for AHP.

Nilüfer Orhan, PhD

Orhan is a pharmacist with expertise in pharmacognosy, phytotherapy, and botany. She has worked closely with BAPP since 2021 as an author or co-author of several peer-reviewed publications and has served as the program's social media coordinator since January 2023. Since March 2023, Orhan also has been a consulting editor for ABC's HerbClip research service.



Orhan graduated from the Faculty of Pharmacy at Gazi University in Ankara, Türkiye, in 2002. Her research interests include biological activities of natural products and medicinal plants, qualitative and quantitative analysis of food and plant extracts, and the application of pharmacopeial methods. She also has been involved in the development of a traditional herbal medicinal product derived from *Helichrysum stoechas* ssp. *barellieri* (Asteraceae) flowers, which is used for urinary stone disease.

From 2002 to 2018, she was a research and teaching assistant and a lecturer in graduate and doctoral programs at Gazi University, Faculty of Pharmacy, Department of Pharmacognosy, where she eventually became professor and held the position until 2020.

Orhan has authored or co-authored more than 40 research articles in scientific publications and six book chapters. She also is the lead author of three BAPP documents, including a Laboratory Guidance Document (LGD) on St. John's wort (*Hypericum perforatum*, Hypericaceae) (December 2021), an LGD on *Boswellia serrata* (Bursaceae) oleogum resins and extracts (September 2022), and a Botanical Adulterants Prevention Bulletin on the adulteration of nigella (*Nigella sativa*, Ranunculaceae) seed and seed oil (October 2022).

Orhan served as the associate editor of the *FABAD Journal of Pharmaceutical Sciences* from 2013 to 2016, and she is a current editorial board member of several scientific journals.

Cassandra Leah Quave, PhD

Quave is the curator of the herbarium and associate professor of dermatology and human health at Emory University in Atlanta, Georgia, where she leads natural products drug discovery research and teaches courses on medicinal plants, microbiology, and pharmacology. In 2023, she was appointed the Thomas J. Lawley, MD Professor of Derma-



tology, an endowed professorship, and the assistant dean of research cores for Emory University School of Medicine.

Quave earned a bachelor's degree in biology and anthropology from Emory University in 2000 and a PhD in biology from Florida International University in 2008.

Her work focuses on documentation and pharmacological evaluation of plants used in traditional medicine. She is a fellow of the Explorers Club, a past president of the Society for Ethnobotany (formerly the Society for Economic Botany), a recipient of the Emory Williams Distinguished Undergraduate Teaching Award (2019), the Society for Ethnobotany's Charles B. Heiser, Jr. Mentor Award (2019), and the American Herbal Products Association's (AHPA's) Herbal Insight Award (2022).

In 2022, she received the Eric and Wendy Schmidt Award for Excellence in Science Communication from the National Academies of Sciences, Engineering, and Medicine. Quave serves on the board of directors of the Society for Investigative Dermatology and on several journal editorial boards.

She is the co-creator and host of "Foodie Pharmacology," a podcast exploring links between food and medicine, and the creator and host of the "Teach Ethnobotany" channel on YouTube, through which she creates and shares educational videos about botanicals, natural products, and pharmacology. She writes a weekly e-newsletter, "Nature's Pharmacy," and has authored or co-authored more than 100 scientific publications and 20 book chapters, edited two books, and has seven issued patents. Her work has been cited in the scientific literature more than 7,200 times.

Quave is the co-founder and chief science officer of Verdant Scientific, a biotech company that focuses on developing new therapies for inflammatory skin disease. *The New York Times Magazine*, BBC Science Focus, *National Geographic*, NPR, PBS, and the National Geographic channel have featured her research. She has written opinion pieces for *The Wall Street Journal* and *The Conversation* and is the author of a science memoir *The Plant Hunter: A Scientist's Quest for Nature's Next Medicines* (Viking, 2021), which received ABC's 2022 James A. Duke Excellence in Botanical Literature Award and was acclaimed by Kirkus Reviews as one of the best books of 2021.

Amy L. Roe, PhD

Roe has more than 20 years of experience as a practicing toxicologist in both the pharmaceutical and consumer product industries through positions at the US Food and Drug Administration's (FDA's) National Center for Toxicological Research (NCTR) and The Procter & Gamble Company (P&G).

She has expertise in general, descriptive, and regulatory toxicology, as well as drug and xenobiotic (a substance foreign to the body)



metabolism and pharmacokinetics (the branch of pharmacology that deals with the movement of drugs within the body). Her industry experience includes safety support of drugs, medical devices, herbal and other dietary supplements, foods, and water filtration devices. She also has experience leading multidisciplinary drug development teams.

Roe received her PhD in toxicology from the University of Kentucky in 1997. In 1999, she joined Procter & Gamble Pharmaceuticals to lead the metabolism group within the Drug Disposition section.

She is currently Principal Toxicologist, Personal Health Care at P&G. She deals in product safety and regulatory affairs and is responsible for developing non-clinical safety programs and regulatory strategies in support of over-the-counter (OTC) drugs, medical devices, and dietary supplement products marketed globally. In collaboration with academia and government regulatory authorities, she is leading an industry-wide effort to develop a framework for assessing herb-drug and herb-herb interactions.

Roe serves on the Steering Committee of the Botanical Safety Consortium, an international association of government, academic, and industry stakeholders. She also serves or has served on numerous professional boards and advisory committees.

Roe is a past president of the Ohio Valley Society of Toxicology and a diplomate of the American Board of Toxicology (DABT). She also previously served on the American Board of Toxicology's Board of Directors and is also a fellow of the Academy of Toxicological Sciences.

Nandakumara "Nandu" Sarma, PhD

Sarma is the director of the Dietary Supplements and Herbal Medicines program at the United States Pharmacopeia (USP), an independent, scientific nonprofit organization that focuses on building trust in the supply of safe, quality medicines. Since 2013, he has been responsible for USP strategy and external stakeholder engagement related to dietary supplements and herbal medicines and has authored publications involving regulations and science of dietary supplement safety and quality, as well as USP admission evaluation of dietary ingredients.

His team works with global stakeholders and expert volunteers on new, innovative projects related to the development of quality standards (monographs and general chapters) that are published in the USP Dietary Supplements Compendium and Herbal Medicines Compendium.

Sarma has led a project to create a botanical library for DNA-based analytical methods, with stakeholder inputs,



and organized a workshop on DNA standards for botanical identification. This work led to the publication of orthogonal methods for identification of multiple ginseng species. He also advocates for the use of quality standards through collaboration with other international standards organizations, including the American National Standards Institute (ANSI), ISO, ASTM International, and AOAC International, as well as governments and other pharmacopeias.

He earned a bachelor's degree in pharmacy from Kakatiya University in Warangal, India, in 1986, a master's degree in pharmaceutical sciences from Banaras Hindu University in Varanasi, India, in 1989, and a PhD in pharmacognosy from Banaras Hindu University in 1994. From 1996 to 2000 he was the senior scientific officer at the Himalaya Drug Company (now called Himalaya Wellness Company), a producer of Ayurvedic herbal medicines.

Sarma has co-authored more than 30 scientific articles in peer-reviewed journals, including a cover article, "Quality Standards for Botanicals: The Legacy of USP's 200 Years of Contributions," in *HerbalGram* issue 126 (Summer 2020).

Michelle A. Simon, PhD, ND

Simon is a licensed naturopathic physician with a background that includes research and engineering experience, clinical practice, and nonprofit leadership. She is the president and CEO of the Institute for Natural Medicine (INM), a nonprofit organization that focuses on educating the public about, and increasing access to, natural medicine options for consumers.



Simon leads all aspects of INM's mission and organizational and program development. She has helped establish national public relations campaigns, childhood nutrition education programs, stakeholder collaborations involving more than 80 organizations, an ambassador program, and a residency program, which is now responsible for about 20% of residencies in the naturopathic medical profession.

She received a bachelor's degree in mechanical engineering from the University of Massachusetts Amherst in 1989, a PhD in biomedical engineering from the University of North Carolina at Chapel Hill in 1993, and a doctorate in naturopathic medicine from Bastyr University in Kenmore, Washington, in 2002.

Simon served for nine years on the inaugural board of the Washington State Health Technology Clinical Committee of the Health Technology Assessment program, which examined the scientific evidentiary basis for efficacy, safety, and cost-effectiveness in the evaluation of health care technologies for coverage determinations for state-purchased health care.

She is also the editor-in-chief of the "Nurify Today" e-newsletter and a board member of KnowEwell, a regenerative health company. She has served on boards of the American Association of Naturopathic Physicians (AANP), the Naturopathic Physicians Research Institute, and several advisory boards.

Bastyr University's "Alumni Newsletter" recognized Simon as a distinguished alumna in 2016, she received the Naturopathic Medical Student Association's Helping Hand award in 2018, the AANP recognized her as a Physician of the Year in 2018, and the Washington Association of Naturopathic Physicians named her the 2022 Champion of Naturopathic Medicine.

Donna Webster, PhD

Webster is a senior principal scientist in Global Product Science and Safety, Product Science and Innovation, at Herbalife, a Los Angeles, California-based global company that offers a range of nutrition products and dietary supplements.

During her 14-year tenure at Herbalife, she has helped provide substantiation of health benefits and ensure safety of foods, dietary supplements, and personal care products. This includes evaluation of new ingredients during product development and compilation of documents to support safety and claims for these products. She previously coordinated research on botanical identification with the University of California, Los Angeles (UCLA) and the University of Mississippi. Currently, she focuses on tea products, along with products for brain health and "beauty from within."

Webster received a bachelor's degree in biology from Pennsylvania State University in 1998, a master's degree in forensic science from the University of Illinois-Chicago (UIC) in 2003, and a PhD in pharmacognosy from UIC in 2008.

From 2005 to 2008, she was a research fellow at UIC and investigated opioid activity of botanical supplements for women's health, specifically chasteberry (*Vitex agnus-castus*, Lamiaceae) and related species and black cohosh. Her research was conducted in collaboration with the UIC Botanical Research Center, an NIH-funded center that investigates plants that are reported to alleviate the symptoms of menopause and premenstrual syndrome.

She is a diplomate of the American Board of Toxicology (DABT) and belongs to numerous professional organizations. She has co-authored several scientific publications on green tea (*Camellia sinensis*, Theaceae) and herbs for women's health. ■



ADOPT-AN-HERB

HerbMedPro™

P R O G R A M

The American Botanical Council's Adopt-an-Herb Program provides a mutually beneficial opportunity to support ABC's nonprofit educational efforts and promote a company's most important herbs.

One of the benefits of supporting the Adopt-an-Herb Program is that it ensures that the most current information on the adopted herb is available through ABC's powerful HerbMedPro™ database.

HerbMedPro provides online access to abstracts of scientific and clinical publications on more than 250 commonly used medicinal herbs. A free version, HerbMed®, is available to the general public and includes access to adopted herbs. HerbMedPro is available as a member benefit to all ABC members at the Academic Membership level and up.

In addition to ensuring that recently published information on an adopted herb is up to date on HerbMedPro, another benefit adopters enjoy is being included among their peers in each issue of ABC's acclaimed quarterly, peer-reviewed scientific journal, *HerbalGram*, on the ABC website, and at scientific, medical, and other educational conferences. Press releases also are issued on new adoptions, bringing attention to the program, the adopted herb, and the adopting company. Each adopted herb is featured on its own page on the ABC website.












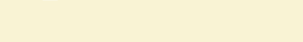
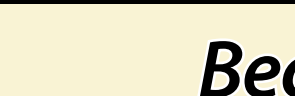
Parties interested in taking part in the Adopt-an-Herb Program are invited to contact ABC Development Director Denise Meikel at 512-926-4900, extension 120, or by email at denise@herbalgram.org.



CELEBRATING 40 YEARS OF
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AMERICAN
BOTANICAL
COUNCIL

Herbal Adopters















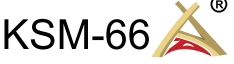


	Milk Thistle <i>Silybum marianum</i>		Kesum <i>Persicaria minor</i>
	Fig <i>Ficus carica</i>		Tongkat Ali <i>Eurycoma longifolia</i>
	Oat <i>Avena sativa</i>		Indian Frankincense <i>Boswellia serrata</i>
	Saffron <i>Crocus sativus</i>		Senna <i>Senna alexandrina</i>
	Propolis		Black Chokeberry <i>Aronia melanocarpa</i>
	Turmeric <i>Curcuma longa</i>		Elderberry <i>Sambucus nigra</i>
	Sceletium <i>Sceletium tortuosum</i>		Stinging Nettle <i>Urtica dioica</i>
	Maca <i>Lepidium meyenii</i>		Lemon Balm <i>Melissa officinalis</i>
	Ginkgo <i>Ginkgo biloba</i>		Broccoli <i>Brassica oleracea</i> Broccoli Group
	Devil's Claw <i>Harpagophytum spp.</i>		Peppermint <i>Mentha x piperita</i>
	Plant name <i>Scientific name</i>		Plant name <i>Scientific name</i>

Become an Adopter today!

Visit us at www.herbalgram.org/adopt

Contact Denise Meikel at 512-926-4900 x120
or by email at denise@herbalgram.org

Herbal Adopters

	Kava <i>Piper methysticum</i>		Echinacea <i>Echinacea spp.</i>
	Rhodiola <i>Rhodiola rosea</i>		Bilberry <i>Vaccinium myrtillus</i>
	Nopal/Prickly Pear <i>Opuntia ficus-indica</i>		California Poppy <i>Eschscholzia californica</i>
	Asian Ginseng <i>Panax ginseng</i>		Bergamot <i>Citrus bergamia</i>
	Sophora Japonica <i>Styphnolobium japonicum</i>		Acacia Gum <i>Acacia senegal</i> (syn. <i>Senegalia senegal</i>), <i>Acacia seyal</i> (syn. <i>Vachellia seyal</i>)
	Monk Fruit <i>Siraitia grosvenorii</i>		Andrographis <i>Andrographis paniculata</i>
	Rose Hip <i>Rosa canina</i>		Tart Cherry <i>Prunus cerasus</i>
	Alfalfa <i>Medicago sativa</i>		Black Currant <i>Ribes nigrum</i>
	Olive <i>Olea europaea</i>		Purple Corn <i>Zea mays</i>
	Grape <i>Vitis vinifera</i>		Cranberry <i>Vaccinium macrocarpon</i>
	Lavender <i>Lavandula angustifolia</i>		Saw Palmetto <i>Serenoa repens</i>
	Pomegranate <i>Punica granatum</i>		Arnica <i>Arnica montana</i>
	Ashwagandha <i>Withania somnifera</i>		Hops <i>Humulus lupulus</i>
	Hibiscus <i>Hibiscus sabdariffa</i>		Birch <i>Betula spp.</i>
YOUR LOGO	Plant name <i>Scientific name</i>	YOUR LOGO	Plant name <i>Scientific name</i>

America Natural Ingredients, Eurofins, and Jiaherb Adopt Botanicals through ABC’s Adopt-an-Herb Program

By ABC Staff



The American Botanical Council (ABC) recently announced three herb adoptions through its Adopt-an-Herb botanical research and education program:

America Natural Ingredients’ (ANI’s) adoption of nopal/prickly pear (*Opuntia ficus-indica*, Cactaceae), Eurofins’ adoption of California poppy (*Eschscholzia californica*, Papaveraceae), and Jiaherb’s adoption of kava (*Piper methysticum*, Piperaceae).

These adoptions support ABC’s extensive HerbMedPro database, a comprehensive, interactive online database that provides access to important scientific and clinical research data on the uses and health effects of more than 265 herbs, spices, medicinal plants, and fungi. Through their support, these adopters ensure that this unique research and educational resource remains up to date for researchers, health professionals, industry members, students, consumers, and other members of the herbal and dietary supplement and natural medicine communities.



Nopal
Opuntia ficus-indica
Photo ©2024 Steven Foster Group

America Natural Ingredients Adopts Nopal

Opuntia ficus-indica is in the cactus family and likely originated in Mexico. *Nopal* (plural: *nopales* or *nopalitos*) is the Spanish name for the edible pads, or modified stems of the plant (called cladodes). Traditionally, they are used to treat high cholesterol, diabetes, hangovers, and obesity. Clinical trials have documented that nopal can help maintain blood sugar levels for people with type 2 diabetes and shows potential benefits for cholesterol and weight management.

“We at America Natural Ingredients recognize that the benefits of nopal are not well known, and we hope to change that so that nopal will be used more in dietary supplements,” said Francisco Zúñiga, director of ANI. “In partnering with nopal farmers, we hope that we can improve their lives and generate pride in our common objective to spread knowledge of the benefits of nopal.”

Nopal is an example of food as medicine, having been popular in Mexican, New Mexican, and Tex-Mex/*Tejano* cuisine for generations. Prickly pear refers to the entire plant and, more specifically, to the purple, seed-filled fruit (or *tuna*), which is covered with tiny, prickly hairs called glochids. Tunas are eaten raw, made into drinks (*agua fresca* or *agua de tuna*), or cooked to make syrups, jellies, jams, and candy. Clinical trials have documented the fruit’s ability to



Nopal/Prickly Pear
Opuntia ficus-indica

lower blood glucose levels and its anti-inflammatory and cholesterol-lowering benefits.

Opuntia ficus-indica is self-fertile and can reproduce when other plants of its species are not close by. The plant also hybridizes easily, and many cultivars can be found throughout semi-arid regions of the world. Some are almost spineless and with less pronounced glochids than the wild species, making it a viable addition to home gardens.

“On behalf of all of us here at ABC, I am deeply grateful for ANI’s adoption of nopal on ABC’s robust HerbMedPro database,” said ABC Executive Director Mark Blumenthal. “I grew up on the Mexican and New Mexican borders in El Paso, in the Chihuahuan Desert. There, nopal, or prickly pear, was a common plant that

we would find on our frequent hikes into the mountains and arroyos (gullies). Nopal was almost everywhere in the hot, dry, high desert environment.”

About America Natural Ingredients

Nevada-based ANI is an exclusive business agent of SALUTARY, a Mexican company that produces certified organic nopal from the species *Opuntia ficus-indica* and has produced and exported its products to the United States and Japan since 2014. Its *Opuntia ficus-indica* is authenticated by high-performance liquid chromatography (HPLC) and DNA testing. ANI offers nopal powders and tea-cut pieces and is committed to providing functional and avant-garde solutions in the food and health industries, both in Mexico and internationally.

Eurofins Adopts California Poppy

California poppy is a relatively short-lived perennial native to western North America, from Baja California north to southern Washington. It has been naturalized on roadsides, meadows, and hillsides at low elevation throughout the West, Southwest, and Mountain West of the United States. Single, showy, four-petaled, yellow-to-orange flowers open on sunny days atop loosely mounded, ferny, blue-green foliage. While published clinical research on the plant’s therapeutic benefits is limited, the whole plant (aerial parts and roots) has a long history of traditional use for sleeplessness, restlessness, mental stress, overexcitement, reducing spasms, and as a mild analgesic.



California poppy
Eschscholzia californica
 Photo ©2024 Steven Foster Group

 **eurofins** | Botanical Testing

California Poppy
Eschscholzia californica

California poppy is a member of the poppy family. However, unlike the opium poppy (*Papaver somniferum*), the actions of California poppy are mild and non-narcotic. Its benefits are believed to be due to the plant's isoquinoline alkaloids.

“As a third-party testing laboratory, we serve our community by providing education and analysis to support the safety, purity, and strength of botanical ingredients and products,” said Scott Kneeder, business unit manager for Eurofins. “The California state flower has a long history of traditional and novel medicinal applications. There are documented traditional uses of the whole plant, including roots, leaves and flowers, to promote sleep and to treat pain, neuralgia, anxiety, stress, depression, and migraines in adults and children. It is not considered an opiate or addictive. According to the State of California website (CA.gov), this flower is viewed as a floral representation of the ‘fields of gold.’ We adopted it to represent our company’s commitment to serving industry and the community in which we are located.”

Blumenthal said: “ABC is deeply grateful to Eurofins for its adoption of California poppy on ABC’s HerbMedPro database. We truly appreciate Eurofins’ focus on this plant that has such a wide array of commercial and health-related applications.”

About Eurofins

According to the company, Luxembourg-based Eurofins Scientific, through its subsidiaries, is the world leader in food, environmental, pharmaceutical, and cosmetic product testing, discovery pharmacology, forensics, advanced material sciences, and agroscience contract research services. Founded in 1987, it is also one of the global independent market leaders in genomics and supporters of clinical studies, as well as in biopharma contract development and manufacturing. Eurofins is one of the key emerging players in specialty esoteric and molecular clinical diagnostic testing in Europe and the United States.

The company also states that, with more than 62,000 staff across a network of independent companies in 61 countries and approximately 900 laboratories, Eurofins offers a portfolio of more than 200,000 analytical methods for evaluating the safety, identity, composition, authenticity, origin, and purity of biological substances and products, as well as for innovative clinical diagnostics. The objective of Eurofins companies is to provide their customers with high-quality services, accurate results on time, and expert advice of their highly qualified staff.

Jiaherb Adopts Kava

Kava, also known as kava kava, is a member of the pepper family and is native to the South Pacific Islands of Vanuatu, Fiji, and surrounding islands. Kava rhizomes (lateral underground stems that shoot off the roots) have been used for millennia to prepare a beverage for ceremonial and medicinal purposes. Traditionally, the rhizomes are pounded or ground and steeped in water to create a relaxing brew, also called kava, which is used to promote sleep and reduce stress. Kavalactones are the primary active ingredients that are responsible for kava’s antianxiety and neuroprotective effects. In human clinical trials, kava extracts have correlated with improvements in mood and generalized anxiety disorders.

According to Jiaherb President Scott Chen: “Jiaherb’s mission is to continuously research, develop, and source innovative ingredients that benefit people’s health. At Jiaherb, we always focus on developing natural ingredients that have been clinically demonstrated to help people improve their health. Not only is kava one such ingredient, but our new super-critical extraction process will bring the kava extract to a new standard.”

Chen said that Jiaherb uses only the “noble” kava variety, which is sourced from the island of Vanuatu and which botanists have determined is the original botanical source of the brew kava. The company also has adopted rhodiola (*Rhodiola rosea*, Crassulaceae) through ABC’s Adopt-an-Herb program.

“ABC is deeply grateful to Jiaherb for adopting kava on ABC’s HerbMedPro database,” said Blumenthal. “Kava has a long history of traditional use and is highly revered by South Pacific Islanders, who use it both ceremonially and medicinally. Jiaherb’s kava adoption enables ABC to further its unique nonprofit research and educational mission.”

About Jiaherb

Founded in Xi’an, China, in 2000, Jiaherb is an NSF-good manufacturing practice (GMP)-certified natural ingredients manufacturer. According to the company’s website, it offers 100% traceability of its ingredi-



Kava
Piper methysticum

ents and upholds ethical values toward sustainability. To this end, it launched the Herbalink™ botanical identification program, which, according to Jiaherb, implements stringent testing methods throughout processing and preparation and documentation of the ingredient's journey from harvest to packaging.

Chris Oesterheld, Jiaherb vice president, said: “The core of our sustainability strategy creates value through social, economic, and environmental means, and with kava, we are exercising these exact strategies. We are proud of being associated with such a reputable and respected organization as the American Botanical Council. This partnership directly reflects our core values of making a positive impact in our industry. Through this adoption, we take pride in providing information that helps our industry recognize the human health benefits of kava. We are committed to and focused on continuing our research and sustainability efforts for this amazingly impactful ingredient.”



Kava
Piper methysticum
Photo ©2024 Steven Foster Group

About Adopt-an-Herb and HerbMedPro

America Natural Ingredients, Eurofins, and Jiaherb are among the 74 US and international companies and organizations that have supported ABC's educational efforts to collect, organize, and disseminate reliable traditional and science-based information, including clinical studies, on herbs, medicinal plants, and other botanical- and fungal-based ingredients through the Adopt-an-Herb program. This program encourages companies, organizations, and individuals to “adopt” one or more specific herbs for inclusion and ongoing maintenance in the HerbMedPro database. To date, 85 herbs have been adopted.

Each adopted herb is researched continuously for new scientific articles in the areas of botanical, chemical, pharmacological, toxicological, and clinical studies, ensuring that its HerbMedPro record stays current and robust. Access to the studies is organized conveniently by publication type, with each study condensed to a one-sentence summary with a link to the study's official abstract on PubMed (the US National Library of Medicine's free-access database) or other publicly accessible databases.

HerbMedPro is available to ABC members at the Academic level and higher. Its “sister” site, HerbMed, is available to the public at no cost, with access to 25-30 herb records from the larger HerbMedPro database, along with all the adopted herbs. In keeping with ABC's position as an independent nonprofit research and education organization, herb adopters do not influence the scientific information that is compiled for their respective adopted herbs. 🇺🇸

ADOPT-AN-HERB
HerbMedPro™ PROGRAM

ABC's Mark Blumenthal Named '2023 Person of the Year' by *WholeFoods Magazine*

By ABC Staff

In November 2023, *WholeFoods Magazine*, a leading natural products industry trade publication, announced that it named American Botanical Council (ABC) Founder and Executive Director Mark Blumenthal its “2023 Person of the Year.” *WholeFoods Magazine* featured the cover article in its December issue, which is available online.¹

The article, written by *WholeFoods Magazine* Content Director Maggie Jaqua, and sidebars chronicle Blumenthal's extensive activities in the herb and natural products community over the past 50 years, mostly as the co-founder and editor-in-chief of ABC's journal *HerbalGram*, founder and executive director of the international nonprofit ABC, and founder of the ABC-AHP-NCNPR Botanical Adulterants Prevention Program.

The article also mentions that he was a co-founder and president of the Herb Trade Association in the late 1970s and a founding board member of the American Herbal Products Association (AHPA). Blumenthal's activi-

ties at ABC have focused on education, research, ethnobotany, phytomedicine, quality issues, conservation and sustainability, and other aspects of the organization's mission, publications, and programs.

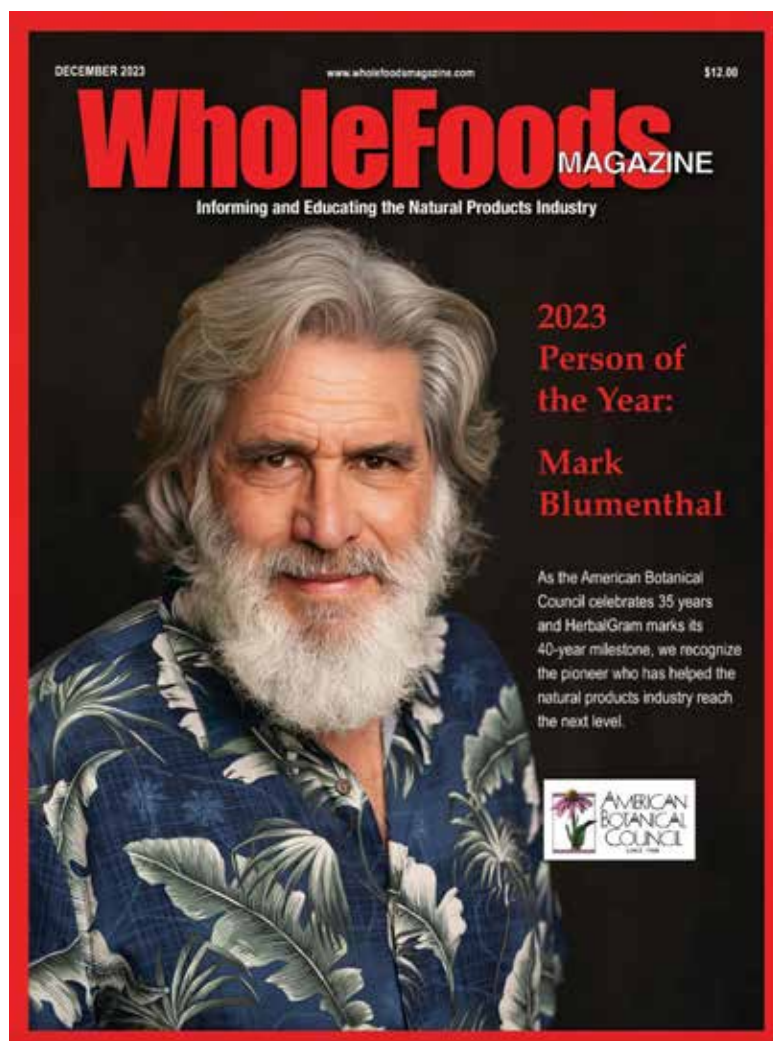
He edited or co-edited scientific reference books, including the award-winning *The Complete German Commission E Monographs: Therapeutic Guide to Herbal Medicines* (American Botanical Council and Integrative Medicine Communications, 1998), *Herbal Medicine: Expanded Commission E Monographs* (Integrative Medicine Communications, 2000), *The ABC Clinical Guide to Herbs* (American Botanical Council, 2003), and *Rational Phytotherapy: A Reference Guide for Physicians and Pharmacists*, 5th edition (Springer, 2004). Blumenthal serves or has served on numerous editorial boards of magazines and journals related to botanical and natural medicine, as well as the advisory boards of many nonprofit organizations and educational programs. He and ABC were also instrumental in producing one of the first herbal medicine continuing education (CE) courses for pharmacists in the 1990s, including groundbreaking CE-accredited “Pharmacy from the Rainforest” ethnobotany ecotours in the Peruvian Amazon.

“Mark Blumenthal has raised the bar in the natural products industry, and he helped us to be better and do better in the process,” Heather Wainer, publisher and VP of media at *WholeFoods Magazine*, wrote in the Publisher's Letter of the December 2023 issue.²

“ABC also has been instrumental in helping to keep this industry ethical and transparent,” Wainer added. “Most recently, ABC has taken a lead role in the fight against adulteration of herbs. BAPP has been in the forefront and is slowly but surely helping to gain transparency in herbs and cleaning up our herbal products.

“In recognition of Mark's efforts to deliver education for four decades through *HerbalGram*, as well as for his work with BAPP and his fight for clean unadulterated herbs, Mark stands out as our 2023 Person of the Year.”

A sidebar in the cover article contains comments from natural product industry



leaders: Loren Israelsen, president of the United Natural Products Alliance; Greg Ris, vice president of sales at Indena USA; Elan Sudberg, CEO of Alkemist Labs; Howard Wainer, president of Wainer Finest Communications Inc.; Ann Armbrrecht, PhD, director of ABC's Sustainable Herbs Program; and Len Monheit, CEO of Industry Transparency Center. In the online version, three ABC employees (Hannah Bauman, *HerbalGram* associate editor; Cecelia Thompson, finance coordinator; and Gayle Engels, special projects director) express their views about working at ABC.

"I am deeply grateful that *WholeFoods Magazine* has chosen to honor the unique and extensive nonprofit research and educational work of the American Botanical Council with this recognition," said Blumenthal. "I also thank the amazingly dedicated and productive staff of ABC, who help ensure that ABC makes such positive contributions to the herbal community in the United States and internationally. And, I have profound gratitude to the loyal members, donors, and supporters of ABC, who make possible the nonprofit organization's unique educational mission, publications, and programs."

Blumenthal is also grateful for his long history with *WholeFoods Magazine*. "As *WholeFoods* publisher Heather Wainer notes in her column, I have known her since she started in the natural products industry in the 1990s, and I have known her father, *WholeFoods* President Howie Wainer, for about 45 years. My relationship with *WholeFoods* began when he asked me to write a monthly article on herbs, shortly after he purchased the magazine in 1984. In fact, as noted in a quote from Howie, he got me started as a writer early in my career in the herb and natural products community when he invited me to write a column for the former industry trade magazine for which he was previously working, *Health Food Business*, starting around 1978. I am grate-

ful to Howie for starting me on the path of writing (and editing) — two things I continue to do in service to the natural products community."

The release of the *WholeFoods Magazine* tribute to Blumenthal coincides with ABC's 35th anniversary as a leading nonprofit research and education organization and the 40th anniversary of ABC's flagship publication *HerbalGram*. ABC has set up a page on its information-rich website about the organization's HerbalGram40 Project & Fund.³

About *WholeFoods Magazine*

WholeFoods Magazine is a monthly trade publication that focuses on the natural products and dietary supplement industry. The magazine was founded in 1977 and has been owned by Wainer Finest Communications since 1984. Its monthly print circulation is more than 13,000. *WholeFoods Magazine* is not affiliated with the Austin, Texas-based Whole Foods Market chain of natural grocery stores. **H**

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Botanical Adulterants Prevention Program Publishes English Lavender Essential Oil Laboratory Guidance Document

New publication evaluates laboratory analytical methods to authenticate English lavender essential oil and detect adulteration with lower-cost materials

By ABC Staff

In October 2023, the ABC-AHP-NCNPR Botanical Adulterants Prevention Program (BAPP) published a Laboratory Guidance Document (LGD) on English lavender (*Lavandula angustifolia*, Lamiaceae) essential oil.

The essential oil of English lavender, also known as “common lavender” or simply “lavender,” is made by steam distillation of the flowering tops of the plant, a small shrub that belongs to the mint family and is native to the Mediterranean. The oil is widely used orally or in aromatherapy via inhalation to help allay anxiety and promote restful sleep. Lavender oil is also a popular ingredient in massage oils and personal care, home care, and cosmetic products.

The wholesale price of authentic English lavender essential oil ranges from \$75 to \$100 per liter. Due to its relatively high price, undisclosed substitution with essential oils from other, lower-cost species of *Lavandula* appears to be common. One reported adulterant of English lavender is the essential oil of lavandin (*Lavandula × intermedia*), which is a hybrid of *L. angustifolia* and spike lavender (*L. latifolia*), although some authorities consider lavandin to be an acceptable substitute.

Other forms of adulteration of English lavender essential oil include the undeclared addition of other essential oils, or oil fractions (part of the essential oil usually obtained by fractionated distillation, a process that separates the essential oil according to the volatility of the constituents) that are rich in the natural compound linalool. Mixtures of undisclosed synthetic or purified chemicals, such as linalool and linalyl acetate, or non-volatile fatty oils like sunflower (*Helianthus annuus*, Asteraceae) oil added as a diluent, also have been reported.

Oleksandr Shulha, PhD, an expert in natural products chemistry and analysis based in Cherkasy, Ukraine, wrote the new LGD. It provides an evaluation of macroscopic and microscopic features for English lavender flowers and 48 other analytical methods, including 17 gas chromatography and seven infrared spectroscopy methods, with respect to their suitability to properly determine the identity of lavender essential oil. Sixteen medicinal plant quality control experts from academia and the herb industry in the United States and internationally reviewed the LGD before publication.

“English lavender is a name often misused by laymen due to its morphological and chemical similarities with other species of *Lavandula* and its commercial hybrid lavandin,” said essential oil expert Kemal Hüsnü Can Başer, PhD, a professor in the Department of Pharmacognosy of the Faculty of Pharmacy at Near East University in Nicosia (Lefkoşa, Northern Cyprus). Başer is the co-editor of *Handbook of Essential Oils: Science, Technology, and Applications*, 2nd edition (CRC Press, 2015), which received the 2016 ABC James A. Duke Excellence in Botanical Literature Award.

ABC AHP NCNPR
Botanical Adulterants Prevention Program
American Botanical Council • the American Herbal Pharmacopoeia • the University of Mississippi's National Center for Natural Products Research

English Lavender Essential Oil Laboratory Guidance Document

By Oleksandr Shulha, PhD

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Correspondence: email

Citation (JAMA style): Shulha O. English lavender oil laboratory guidance document. Austin, TX: ABC-AHP-NCNPR Botanical Adulterants Prevention Program. 2023.

Keywords: Adulteration, essential oil, *Lavandula angustifolia*, English lavender, lavender, common lavender, lavender essential oil

1. Purpose
Lavender oil obtained from the flowers of English lavender (*Lavandula angustifolia* Mill., Lamiaceae) is widely used in the production of fragrances, cosmetics, food, beverage products, and pharmaceuticals. The essential oil (EO) is used orally, by inhalation as a sleep aid, and can be applied topically for skin treatment. Adulteration of lavender oil is considered to be widespread due to high product demand and lower prices for chemically similar EOs and compounded fragrances. Some of the known adulterants are EOs from spike lavender (*Lavandula latifolia* Medik.) or lavandin (*Lavandula × intermedia* Emeric ex Loisel, syn. *Lavandula angustifolia* Mill. × *Lavandula latifolia* Medik.), vegetable oils, glycols, and naturally occurring volatile compounds from lower-cost sources (linalool, linalyl acetate, lavandulyl acetate).¹ This Laboratory Guidance Document (LGD) presents a review of various analytical methods used to detect adulteration of EO of English lavender with lavandin, spike lavender, linalool and linalyl acetate-rich EOs, terpenes, and other chemicals. This document can be used in conjunction with the “Adulteration of English Lavender (*Lavandula angustifolia*) EO Botanical Adulterants Prevention Bulletin” published by the ABC-AHP-NCNPR Botanical Adulterants Prevention Program in 2020.¹

English Lavender Essential Oil - Laboratory Guidance Document • Sept 2023 • www.botanicaladulterants.org

1



English lavender
Lavandula angustifolia
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Başer noted that the International Organization for Standardization (ISO) has standards for lavender and lavandin oils, and the *European Pharmacopoeia* contains monographs for lavender and spike lavender oils. “These standards can help authenticate the essential oils,” he said.


Stefan Gafner, PhD, chief science officer of the nonprofit American Botanical Council (ABC) and director of BAPP, explained: “Some methods of lavender oil adulteration are easy to detect. For example, vegetable oils or compounds known as glycols leave a liquid residue when a drop of oil is placed on filter paper, while essential oils evaporate. On the other hand, some types of adulteration are difficult to determine because fraudsters have found ways to produce materials that closely resemble authentic English lavender oil. The new BAPP LGD provides an overview of available laboratory analytical methods and their strengths and limitations, so quality control personnel in various industries can readily find the right approach for their needs.”

The lavender essential oil LGD is BAPP’s 16th LGD and 83rd peer-reviewed publication since its first publication in 2011. As with all BAPP publications, the English lavender essential oil LGD is freely available on BAPP’s website (registration required).

About the ABC-AHP-NCNPR Botanical Adulterants Prevention Program

The ABC-AHP (American Herbal Pharmacopoeia)-NCNPR (National Center for Natural Products Research at the University of Mississippi) Botanical Adulterants Prevention Program is an international consortium of nonprofit professional organizations, analytical laboratories, research centers, industry trade associations, industry members, and other parties with interest in herbs, medicinal plants, essential oils, and medicinal fungi. BAPP advises industry, researchers, health professionals, government agencies, the media, and the public about various challenges related to adulterated botanical ingredients in commerce in the United States and internationally. To date, more than 200 US and international parties have financially supported or otherwise endorsed BAPP.

BAPP has published 83 extensively peer-reviewed articles, including Botanical Adulterants Prevention Bulletins, LGDs, and “Botanical Adulterants Monitor” e-newsletters, all freely available on BAPP’s website.

In 2023, the *Journal of Natural Products* published a review of BAPP’s work in the area of adulteration and fraud in the global botanical marketplace. The review documents how fraudsters intentionally manipulate various botanical materials so that they can deceive prevalent laboratory analytical methods used by industry, third-party, and government quality control laboratories. The full article is available online for free.¹ 

Reference

1. Gafner S, Blumenthal M, Foster S, Cardellina JH, Khan IA, Upton R. Botanical ingredient forensics: Detection of attempts to deceive commonly used analytical methods for authenticating herbal dietary and food ingredients and supplements. *J Nat Prod.* 2023;86(2):460-472. doi: 10.1021/acs.jnatprod.2c00929.

Clinical Efficacy of Combined Pomegranate Extract and Vitamins for Treatment of Chronic Fatigue

Reviewed: Ullah H, Sommella E, Minno AD, et al. Combination of chemically characterized pomegranate extract and hydrophilic vitamins against prolonged fatigue: A monocentric, randomized, double-blind, placebo-controlled clinical trial. *Nutrients*. June 2023;15(13):2883. doi: 10.3390/nu15132883.

By Shari Henson

Chronic fatigue syndrome is a severe and often disabling condition characterized by a sense of exhaustion after activities and tiredness at rest that lasts for at least six months. In contrast, acute fatigue is a physiological reaction to intense and prolonged activity that is usually transient and does not interfere with routine activities. “Prolonged fatigue,” an intermediate state of fatigue, is considered mild and generally lasts for less than six months. Despite the high prevalence of prolonged fatigue, high-quality studies that have identified effective treatments for this condition are limited.

Pomegranate (*Punica granatum*, Lythraceae) fruit is rich in dietary polyphenols. Its bioactive compounds are associated with its antioxidant, anti-inflammatory, cardioprotective, hepatoprotective, antimicrobial, antiviral, antidiabetic, neuroprotective, and dermatologic properties. Hydrophilic vitamins, including B vitamins and vitamin C, are important in preventing chronic degenerative disorders due to their health effects. The authors of the reviewed study reported the results of a monocentric, randomized, double-blind, placebo-controlled clinical trial conducted to assess the efficacy of Improve[®] Response (Esse Pharma Srl; Rome, Italy), a food supplement that contains a standardized, chemically characterized pomegranate extract and hydrophilic vitamins, against prolonged fatigue.

Pomegranate extract was obtained by mixing a hydroalcoholic solution with various parts of the pomegranate fruit, particularly the peel. The resultant solution was concentrated and spray-dried to obtain the standardized extract. An analysis of the pomegranate extract using ultra-high-performance liquid chromatography high-resolution mass spectrometry revealed the presence of 59 compounds, with gallotannins and ellagitannins being the most abundant phytochemicals.

Single-dose stick packs of the food supplement Improve Response contained 500 mg of pomegranate extract, 200



Pomegranate
Punica granatum
Photo ©2024 Steven Foster Group

Study Details: At a Glance	
Study Design	Monocentric, randomized, double-blind, placebo-controlled clinical trial
Duration	56 days of treatment
Participants	58 men and women with mild to moderate fatigue
Intervention	Improve [®] Response (Esse Pharma Srl; Rome, Italy), a food supplement that contains pomegranate extract and hydrophilic vitamins
Control	Placebo
Disclosures	Author C. Riccioni is an employee of Esse Pharma Srl. The other authors did not disclose any conflicts of interest.

mg of vitamin C (L-ascorbic acid), 16 mg of niacin (nicotinamide), 7 mg of vitamin B₂ (riboflavin), 6 mg of vitamin B₅ (D-pantothenate, calcium), 5.55 mg of vitamin B₁ (thiamine hydrochloride), 4 mg of vitamin B₆ (pyridoxine hydrochloride), 200 µg of folate (pteroylmonoglutamic acid), 50 µg of D-biotin, and 12.5 µg of vitamin B₁₂ (cyanocobalamin). Soluble granules of the placebo in stick packs contained inert excipients.

Comegen, a cooperative of physicians focused on clinical, epidemiological, and pharmacological research, conducted the study in Naples, Italy. In February 2023, Comegen general practitioners recruited 22 men and 36 women aged 18-75 years. Participants had mild to moderate fatigue, as indicated by a score of less than 5 on the Fatigue Severity Scale (FSS), a 9-item scale that measures the severity of fatigue and its effects on a person's lifestyle. The authors excluded people who scored 5 or higher on the FSS (indicating more severe fatigue) or who had chronic fatigue lasting for six months or longer.

The primary outcome of the study was the change in fatigue severity as indicated on the FSS. Secondary outcomes included improvement in quality of life as indicated on the 12-Item Short Form Health Survey (SF-12) and changes in fatigue-associated biomarkers.


During the screening visit, participants completed the FSS questionnaire and were randomly assigned to two groups of 29 people each. At the baseline visit, participants consumed a stick-pack of the food supplement or placebo. They continued the treatment daily for 56 days. Participants were evaluated after 28 days, after 56 days, and at a follow-up visit 28 days after the discontinuation of the

placebo or food supplement. Blood draws at baseline and after 56 days of treatment were used to measure biomarkers of fatigue and stress.

In the food supplement group, a significant improvement in FSS scores was observed from baseline to 28 days ($P = 0.010$) and from 56 days to the follow-up visit ($P < 0.001$). A decrease in FSS scores from 28 days to 56 days was not significant. No significant changes were observed in FSS scores in the placebo group. Between-group comparisons reveal significantly lower FSS scores in the food supplement group compared with the placebo group at 56 days ($P < 0.001$) and at the follow-up visit ($P < 0.001$).

The authors reported “a slight tendency toward an increase” in SF-12 quality-of-life scores in the treatment group, but these changes were not significant ($P = 0.91$). Biochemical markers remained constant and within normal ranges in both groups throughout the study. No adverse effects were reported.

This study has several limitations. According to the authors, they could not show an improvement in quality of life because the number of participants was “insufficient to provide a statistically significant conclusion” for the increase in SF-12 scores. In addition, the mechanisms responsible for the effects of the food supplement remain unknown.

The authors conclude that “a food supplement based on the combination of a chemically characterized pomegranate extract, B vitamins, and vitamin C, supplemented for [56 days] of intake in healthy consumers, reduces prolonged fatigue.” 

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Lemon Balm Extract Reduces Symptoms of Depression and Anxiety in People with Type 2 Diabetes Mellitus

Reviewed: Safari M, Asadi A, Aryaeian N, et al. The effects of *Melissa officinalis* on depression and anxiety in type 2 diabetes patients with depression: A randomized double-blinded placebo-controlled clinical trial. *BMC Complement Med Ther.* May 2023;23(1):140. doi: 10.1186/s12906-023-03978-x.

By Shari Henson

Depression in people with diabetes mellitus can be associated with poor medication adherence, impaired glycaemic control, and an increase in disease complications. People who have both diabetes and depression have a 1.5-fold increase in mortality risk. Lemon balm (*Melissa officinalis*, Lamiaceae) has been reported to have anti-inflammatory, antioxidant, antidepressant, anti-anxiety, and antidiabetic effects. The authors of the reviewed study conducted a randomized, double-blind, placebo-controlled clinical trial to investigate the effects of lemon balm extract on depression, anxiety, and sleep quality in people who have type 2 diabetes and symptoms of depression.



Lemon balm
Melissa officinalis

Photo ©2024 Steven Foster Group

This study was conducted at the Endocrine Research Center of the Institute of Endocrinology and Metabolism at Iran University of Medical Sciences in Tehran, Iran, between May 2017 and May 2019. The study included males and females who were 20-65 years old, had type 2 diabetes for at least one year, and were using hypoglycemic drugs but not insulin. Included participants also had a score greater than 10 on the revised Beck Depression Inventory-II (BDI-II) (with a score of 10 indicating mild depression and higher scores indicating more severe depression); had a body mass index (BMI) less than 35 kg/m²; triglyceride level less than 400 mg/dL; glycated hemoglobin less than 8%; did not smoke or use alcohol; did not take dietary supplements during the three months before the start of the study; and did not use antidepressant, sedative, or anti-anxiety drugs.

At the Institute of Medicinal Plants in Karaj, Iran, aerial parts of lemon balm were washed, dried, and powdered, and the extract was prepared using a hydroalcoholic (70%) solvent. The total flavonoid content of the extract was determined to be 148.06 mg rutin equivalent per gram. Each test capsule contained 8.10 ± 0.04 mg of rosmarinic acid, according to the authors.

Sixty participants were randomly and equally assigned to the intervention and control groups. Participants in the intervention group took two capsules containing 350 mg of lemon balm extract daily, and participants in the control group took two capsules containing 350 mg of toasted wheat (*Triticum aestivum*, Poaceae) flour daily. They were

Study Details: At a Glance	
Study Design	Randomized, double-blind, placebo-controlled clinical trial
Duration	12 weeks
Participants	44 men and women who had type 2 diabetes and were using hypoglycemic drugs but not insulin
Intervention	Researcher-prepared extract of lemon balm (<i>Melissa officinalis</i> , Lamiaceae) aerial parts
Control	Placebo that contained toasted wheat (<i>Triticum aestivum</i> , Poaceae) flour
Disclosures	The authors declared no conflicts of interest.

instructed to take one capsule after lunch and one after dinner for 12 weeks.

Participants were contacted by phone weekly to ensure study compliance. At baseline and after weeks six and 12, their physical activity was estimated using the International Physical Activity Questionnaire (IPAQ), and their daily energy intake, micronutrients, and macronutrients were measured using a 24-hour diet recall questionnaire.


At baseline and at the end of the study, participants completed the BDI-II, Beck Anxiety Inventory (BAI), and Pittsburgh Sleep Quality Index to assess depression, anxiety, and sleep quality. Fasting blood samples were drawn at baseline and at the end of the study.

Forty-four participants completed the study (23 in the intervention group and 21 in the control group). Seven people in the intervention group and nine in the control group did not complete the study due to unwillingness to cooperate ($n = 9$), pregnancy ($n = 1$), illness ($n = 2$), need for insulin therapy ($n = 2$), or diet change ($n = 2$).

At baseline, participants' "basic characteristics" (weight, BMI, age, disease duration, physical activity, and medications) did not differ significantly between the two groups. However, baseline scores for both anxiety and depression were higher in the treatment group than in the placebo group, but these differences were not statistically significant, according to the authors. Still, the differences were not accounted for during the randomization process and could have affected the outcome. (People who are more symptomatic are more likely to improve with time, regardless of treatment.) Physical activity and nutrient intake did not change significantly in either group during the study.

At the end of the study, significant decreases were observed in anxiety and depression symptoms, with greater improvements seen in the intervention group compared with the control group for BDI-II ($P < 0.001$) and BAI ($P = 0.04$) scores. Between-group differences in fasting blood sugar, high-sensitivity C-reactive protein, sleep quality, blood pressure, and anthropometric values were not significant. Compared with baseline, significant improvements in the intervention group were observed in Beck scores for depression ($P < 0.001$) and anxiety ($P = 0.01$). No adverse effects were reported during the study.

The authors acknowledge the lemon balm extract dose may have been inadequate, and analyses of the samples were not specific for presumed active components. Also, the small sample size was a limitation of this study. The BDI-II may lead to possible false-positive results in assessing depression in people with diabetes, according to the authors, who suggest that tools such as the Hospital Anxiety and Depression Scale may be more useful.

In this study, the daily use of lemon balm extract for 12 weeks was associated with reduced symptoms of depression and anxiety in people with type 2 diabetes. Larger clinical trials should further investigate the effects of a standardized lemon balm formulation on mood, sleep disorders, blood pressure, and anthropometric measures. 

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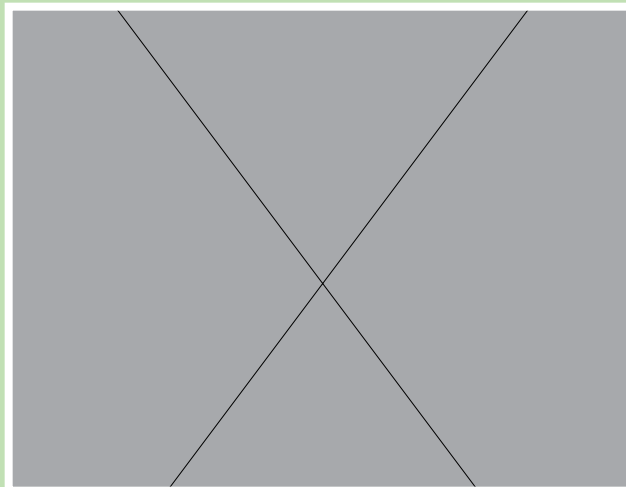
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Hops Extract Improves Bone Health in Postmenopausal Women with Osteopenia

Reviewed: Lecomte M, Tomassi D, Rizzoli R, et al. Effect of a hop extract standardized in 8-prenylnaringenin on bone health and gut microbiome in postmenopausal women with osteopenia: A one-year randomized, double-blind, placebo-controlled trial. *Nutrients*. June 2023;15(12):2688. doi: 10.3390/nu15122688.

By Shari Henson

Postmenopausal women are at risk of developing osteoporosis due to a decline in endogenous estrogen, which increases bone resorption relative to bone formation. Phytoestrogens often are used to alleviate menopausal symptoms such as hot flashes and night sweats and may have beneficial effects on bone health. The hops (*Humulus lupulus*, Cannabaceae) plant is a dietary source of phytoestrogens and contains 8-prenylnaringenin (8-PN), a potent phytoestrogen that some studies suggest may improve bone density. Hops also contains other prenylated phenols such as xanthohumol (X) and isoxanthohumol (IX), which can be metabolically converted to 8-PN.

The authors conducted a parallel, randomized, double-blind, placebo-controlled clinical trial to determine whether long-term consumption of Lifenol® (Givaudan France Naturals; Avignon, France), a hops extract standardized to 8-PN, moderates the decrease in bone mineral density (BMD) in postmenopausal women with osteopenia (a loss of BMD that weakens bones and can lead to osteoporosis) and to explore potential mechanisms of action through modulation of the gut microbiome.

The study was conducted in Cork, Ireland, from August 2019 to December 2020. Of the 221 participants who were screened, 100 healthy postmenopausal women met these criteria: 50-85 years old; more than one year postmenopausal; body mass index (BMI) of 18-32 kg/m²; and the presence of osteopenia, defined as having a dual-energy x-ray absorptiometry (DXA) T-score between -1 and -2.5 g/cm².

Fifty participants each were assigned to the hops extract (HE) group and the placebo group for the 48-week study. Participants in each group took one study capsule (either active or placebo) and two capsules of a calcium and vitamin supplement that contained 500 mg of calcium and 400 IU of vitamin D₃ (Pharmavite; West Hills, California) daily. Each active treatment capsule contained maltodextrin and a hops extract standardized to 100 µg of 8-PN, 110 µg of 6-PN, 1.25 mg of X, and 2.94 mg of IX. Placebo capsules contained maltodextrin only. Capsules were identical in appearance to maintain blinding.

Participants visited a research center at baseline (week 0) and at 12, 24, 36, and 48 weeks for assessments of anthropometric parameters, vitals, quality of life, physical activity, DXA measurements, and dietary intake,

and to provide fecal, blood, and urine samples. Because COVID-19 and Irish government restrictions prohibited visits at weeks 12, 24, and 36, DXA, anthropometric, and laboratory assessments were collected on site later when possible. Three participants in the HE group and two in the placebo group were lost to follow-up. Three participants in the placebo group were excluded from the full analysis set because they did not complete the required evaluations.

Participants' mean age was 62.2 ± 6.3 years, and time since menopause was 12.6 ± 7.1 years. Mean BMI was 24.9 ± 3.1, with 54% of participants within normal range and the remainder in the overweight or obese range. All participants had osteopenia, and the average lowest DXA T-score at any body site was -1.64 ± 0.41 g/cm². Participant compliance was good, and the study capsules were well-tolerated.

Fifty-five treatment-emergent adverse effects in the HE group and 77 in the placebo group were recorded. Of these, 15 in the HE group and 22 in the placebo group were suspected to be related to the study protocol. Two participants in the HE group and three in the placebo group withdrew from the study because of adverse effects suspected to be related to the study product. Two unexpected serious adverse effects in the HE group and four in the placebo group were not related to the study product.

From baseline to the end of 48 weeks, BMD (as determined with DXA) at the L2-L4 lumbar spine increased slightly in the HE group compared with no change in the placebo group. A significant increase in BMD at the femoral neck was observed in both groups at 48 weeks ($P < 0.01$). The between-group differences in BMD at the lumbar spine and femoral neck were not significant. Compared with baseline, total body BMD significantly increased in the HE

Study Details: At a Glance


Study Details: At a Glance	
Study Design	Parallel, randomized, double-blind, placebo-controlled clinical trial
Duration	48 weeks
Participants	100 healthy postmenopausal women
Intervention	Lifenol® (Givaudan France Naturals; Avignon, France), a standardized extract of hops (<i>Humulus lupulus</i> , Cannabaceae), plus a calcium and vitamin supplement
Control	Placebo that contained maltodextrin only, plus a calcium and vitamin supplement
Disclosures	Four of the authors are employees of Givaudan France Naturals, which funded the study. Author D. Tomassi, an employee of Biofortis, was supported by a service agreement with Givaudan France Naturals. R. Rizzoli reported fees for lectures or service on scientific advisory boards from multiple companies, including Givaudan. S. Harney reported no conflicts of interest.

group ($P < 0.0001$); no significant change was seen in the placebo group. The between-group difference tended toward being significant ($P = 0.07$).

Fat mass and visceral fat significantly increased compared with baseline after HE supplementation ($P < 0.05$). Compared with the placebo group, the HE group reported higher fat, calcium, and vitamin K2 intake at the end of the study ($P < 0.05$). Physical functioning (ability to perform daily activities) significantly increased in the HE group compared with the placebo group during the study ($P < 0.05$). No between-group differences were observed in gut microbiome alpha-diversity or in total and individual levels of short-chain fatty acids. However, the HE group experienced a higher abundance of *Turicibacter* and *Shigella* gut bacteria, which have been associated with total body BMD.

The main limitation of this study is the relatively short duration. According to the authors, a period of at least two years would include more complete bone remodeling cycles and further strengthen the DXA evidence in this trial.

The authors concluded that their results “suggest that an 8-PN standardized hop extract could beneficially impact bone health of postmenopausal women with osteopenia.” They also noted that “the magnitude of HE effects on bone density is not comparable to [the effects] of osteoporosis medications, but [HE] could be of interest as a preventative measure for women with low bone mass” who cannot be prescribed medication. 🇺🇸



Hops
Humulus lupulus
Photo ©2024 Steven Foster Group

The Mushroom Moment

By Mark J. Plotkin, PhD

Mushrooms are having a moment. While mushrooms typically are associated with culinary uses — and, sometimes, poisoning — fungal species of the potentially therapeutic variety have captured the popular imagination and seem to be cropping up just about everywhere.

Recently, Chilean biologist Giuliana Furci and her team christened a new species of mushroom, *Psilocybe stametsii* (Hymenogastraceae), in honor of trailblazing mycologist, author, and entrepreneur Paul Stamets.^{1,2} This solitary, tiny, matchstick-sized species, from the cloud forests of the Los Cedros Biological Reserve in northwestern Ecuador, was collected in 2011 by Bryn Dentinger, PhD, and again in 2022 by Furci and her team. Stamets is the protagonist of the 2019 documentary *Fantastic Fungi* and has penetrated the popular consciousness so deeply that he inspired the creation of a character on *Star Trek: Discovery* named — wait for it — “Lieutenant Commander Paul Stamets,” who creates a means of faster-than-light travel by fusing physics and mycology (the study of fungi).

And microdosing — consuming minuscule amounts of hallucinogenic compounds like psilocybin, as detailed in Michael Pollan’s compelling book *How to Change Your Mind* (Penguin Press, 2018)³ — has become an increasingly popular practice. Some proponents believe that it can

enhance creativity, reduce anxiety, relieve insomnia, slow the aging process, generate new nerve cells, and improve hand-eye coordination.⁴

Meanwhile, HBO’s acclaimed series *The Last of Us*, which premiered in January 2023, is based on a video game and inspired by the *Cordyceps* (Cordycipitaceae) fungus, whose unnerving, parasitic life cycle is certainly stranger than most fiction. The fungus attaches itself to and infects a passing ant, devouring its internal organs while spreading slender threadlike fibers known as hyphae throughout the body of the insect. Having taken control of the ant’s body and mind — “puppeteering” the insect, in the words of biologist Merlin Sheldrake, PhD⁵ — the fungus forces the ant to leave the safety of the insect colony and climb onto and bite into a nearby plant. Meanwhile, hyphae grow out of the insect’s feet (tarsi), stitching it to the plant and producing a stalk that punches upward through the ant’s head, killing it and enabling the fungus to release spores that rain down on the forest and insects below.



Maitake mushroom

Grifola frondosa

Photo ©2024 Matthew Magruder



Shiitake mushroom

Lentinula edodes

Photo ©2024 Steven Foster Group



Lion's mane mushroom
Hericium erinaceus
Photo ©2024 Matthew Magruder



Turkey tail mushroom
Trametes versicolor
Photo ©2024 Steven Foster Group

But the *Cordyceps* story has a therapeutic angle as well. Several *Cordyceps* species are highly valued and widely used in tropical Asia. In ancient China, it was used for everything from impotence to lung problems. And, a closely related species, *Tolyptocladium inflatum* (Ophiocordycipitaceae), served as the original source of the pharmaceutical drug cyclosporine, whose discovery opened new doors in immunotherapy, as it was one of the first drugs that safely and effectively suppressed the body's rejection of transplanted organs, helping to make organ transplant surgeries, which were once a pipe dream, an everyday occurrence.

Since the earliest written records, traditional Chinese medicine has made ample use of many fungi for medicinal purposes, and these "folk uses" are now being investigated in labs around the world. *Cordyceps* preparations have shown promise for treating various afflictions⁴ and are already widely valued and sold in many countries for boosting energy levels and enhancing endurance during exercise and competitive sports.

Human use of fungi as a treatment for bacterial and other infections began long before Alexander Fleming's (1881–1955) discovery of penicillin (from *Penicillium* spp., Trichocomaceae) in 1928, which still ranks as one of the most important developments in the history of medicine. "Ötzi," also called the Iceman, the 5,300-year-old Neolithic hunter whose extraordinarily well-preserved body was found by hikers in a glacier in 1991 in the Ötztal Alps on the border of Italy and Austria, was carrying two fungi: tinder fungus (*Fomes fomentarius*, Polyporaceae), which was contained in a pouch and

likely used as tinder to start fires, and two pieces of birch polypore (*Fomitopsis betulina* syn. *Piptoporus betulinus*, Fomitopsidaceae) that were attached to hide strips and possibly used to treat whipworm and/or for antibacterial effects.^{6,7}

Accounts of fungal products used as general-purpose anti-infectives in the ancient world are common. The Egyptians used moldy barley (*Hordeum vulgare*, Poaceae) bread, the Hebrews used spoiled grains, the Greeks employed grime scraped from gymnasium walls, the Aztecs used moldy tortillas, and the Chinese relied on spoiled soybeans (*Glycine max*, Fabaceae).

But it was Fleming's findings in a lab at St Mary's Hospital in London, and the commercial development of penicillin in time to help tip the balance of World War II in the Allies' favor, that sparked major pharmaceutical industry interest in seeking new drugs from the fungal kingdom.

Like *Cordyceps*, *Penicillium* fungi have more than one story to tell. This genus also has given us blue cheese (from *P. roqueforti* and *P. glaucum*) as well as cholesterol-lowering statins (from *P. citrinum*, for example), which are among the most widely used drugs in the industrial world today.

The more we study, the more we find. Mycologist and herbal clinician Christopher Hobbs, PhD, a leading authority on medicinal mushrooms, said that "fungi are increasingly proving to be effective in the lab and the clinic for the prevention, support, and/or treatment of cardiovascular issues, metabolic syndrome, respiratory problems, stress, and overall immune response, as well as increasing energy and improving cognition" (oral communication, August 18, 2022).

That we are now paying significant attention to fungi — be it for medicinal, culinary, industrial, storytelling, or other purposes — makes us very late to the party, considering that fungi first appeared on Earth more than one billion years before humans did.

That we are now paying significant attention to fungi — be it for medicinal, culinary, industrial, storytelling, or other purposes — makes us very late to the party, considering that fungi first appeared on Earth more than one billion years before humans did.⁴ Today, one of the oldest and largest known living organisms on Earth is a fungus: A subterranean specimen of *Armillaria ostoyae* honey fungus (Physalacriaceae), commonly called the “Humongous Fungus,” which covers 2,385 acres (about 3.7 square miles) in the Malheur National Forest in the Blue Mountains of eastern Oregon, may weigh up to 35,000 tons, and may be more than 2,000 years old.^{8,9}

One potentially surprising aspect of fungus biology is that fungi are more closely related to humans than to plants (oral communication with R. Silver, February 1, 2022). This may partly explain why the fungal kingdom has been such an important source of therapeutic compounds for humans and why this little-studied, yet highly diverse, group of organisms remains such a promising source of new medicaments. In the words of Sheldrake: “Penicillin, a compound that could defend fungi from bacterial infection, turned out to defend humans as well.... At a molecular level, fungi and humans are similar enough to benefit from many of the same biochemical innovations.”⁵

Wider use of medicinal mushrooms is underway in the veterinary realm, an industry whose annual value exceeds \$20 billion. Veterinarians who use medicinal mushrooms for their canine patients report excellent results in many cases. Several studies in dogs have been published and detail the potential benefits of certain mushrooms for aggressive canine cancers, such as maitake mushroom (*Grifola frondosa*, Meripilaceae) for lymphoma and turkey tail mushroom (*Trametes versicolor*, Polyporaceae) for hemangiosarcoma (an aggressive form of cancer that affects dogs and starts in the blood vessels). According to veterinarian Robert Silver, DVM, another mushroom, lion’s mane (*Hericum erinaceus*, Hericiaceae), which is popular in the United States for enhancing memory and reducing anxiety, is helping improve the mobility of senior dogs with declining cognitive abilities and improving quality of life in other canines that have anxiety and post-traumatic stress disorder (PTSD) (oral communication with R. Silver, February 1, 2022).

People are embracing the benefits of mushroom diversity in other ways as well. Fifteen years ago, most grocery stores in the United States stocked only white button mushrooms (*Agaricus bisporus*, Agaricaceae). Today, major supermarkets offer a much more diverse fungal buffet: enoki mushrooms (*Flammulina filiformis*, Physalacria-

ceae), lion’s mane, maitake mushrooms, oyster mushrooms (*Pleurotus ostreatus*, Pleurotaceae), porcini mushrooms (*Boletus edulis*, Boletaceae), and shiitake mushrooms (*Lentinula edodes*, Omphalotaceae), as well as cremini and portobello mushrooms, which are more mature, brown versions of the white button mushroom (*A. bisporus*). The annual value of this market has, well, mushroomed to more than \$10 billion per year and is growing at an annual rate of more than 9% (oral communication with C. Hobbs, June 15, 2023).

Physicians and researchers attribute the prevalence of cardiovascular diseases and other ailments, such as type 2 diabetes, at least partly to insufficient consumption of dietary fiber. High consumption of fiber is associated with increased gut microbiota diversity and health. According to Hobbs, edible mushrooms possess some of the highest dietary fiber content of any foodstuff and are rich in vitamins, minerals, and highly digestible proteins, so the demand for culinary mushrooms will likely continue to increase (oral communication, August 18, 2022).

Other creative uses for fungi are proliferating in various sectors, including agriculture, cosmetics, fashion, forestry, music, and pollution control. Mycelia (the fungal equivalent of roots in flowering plants) are a fast-growing, durable, and tough biodegradable fiber that is being employed in the production of “biomaterials”: acoustic panels, construction and packing materials, high-quality leather and high-end clothing, auto parts, furniture, shoes, and even yoga mats and burial suits. And fungi have an unparalleled ability to clean up polluted soil and water, including toxic pollution from petroleum byproducts, and even some radioactive waste — a process termed “mycoremediation” (oral communication with P. Stamets, May 21, 2022).

Stamets and colleagues have investigated fungi-derived options to stave off honeybee diseases and Colony Collapse Disorder, which present a significant threat to the well-being of US agriculture.¹⁰ Fungi also are being studied as a targeted means to attack and destroy insect pests in the home and on the farm. And mycologists believe that many more potential uses for our fungal friends exist.

Fungi are widely regarded as master chemists. Even drugs that were believed to be produced by plants were later learned to be manufactured by fungi: Taxol, a multi-billion-dollar cancer drug first isolated from the bark of the Pacific yew tree (*Taxus brevifolia*, Taxaceae), is now known to be created by endophytic fungi living within the tree.¹¹

In western South America, a small herb known as “piripiri” (*Cyperus* spp., Cyperaceae) has long been valued

Oyster mushroom
Pleurotus ostreatus
Photo ©2024 Steven Foster Group



One of the most promising recent developments in Western medicine is the study and use of hallucinogens to treat intractable ailments like depression and PTSD that feature a significant emotional component, and psilocybin has led the way.

as a versatile and effective plant medicine for various purposes, so much so that it has been called the “ginseng of the Amazon.” After years of study, ethnobotanist Glenn Shepard, PhD, discovered the secret that gives piri-piri its reputed potency: The plant is parasitized by a fungus, which, when studied in the lab, yielded eight novel alkaloids related to lysergic acid diethylamide (LSD), which was itself developed in the lab as a semisynthetic derivative of alkaloids extracted from the ergot fungus (*Claviceps purpurea*, Clavicipitaceae) (oral communication with G. Shepard, June 12, 2023).

And Shepard’s Indigenous guides and teachers have shared with him another botanical healing mystery: The bizarre gentian ghost plant (*Voyria flavescens*, Gentianaceae), which, unlike most flowering plants, produces no chlorophyll and therefore cannot feed itself but extracts

nutrients from fungal partners. According to Shepard, his Indigenous colleagues value this herb for improving hunting skills. They rub the flowers directly into their eyes, claiming this enhances their visual acuity and hand-eye coordination — vital skill upgrades when feeding your family depends on proficiency with a bow and arrow. As with piri-piri, Shepard suspects that the chemical magic of these ghost plants is due to fungi within (oral communication with G. Shepard, October 12, 2023).

One of the most promising recent developments in Western medicine is the study and use of hallucinogens to treat intractable ailments like depression and PTSD that feature a significant emotional component, and psilocybin has led the way. This extraordinary molecule, the active component in the magic mushrooms first taught to ethnobotanist Richard Evans Schultes, PhD (1915–2001), by his Mazatec guides in southern Mexico in 1938, is producing measurable benefits for mental health challenges such as anxiety, depression, substance abuse, eating disorders, and more.¹² And, people in high-stress occupations, from law enforcement to Navy SEALs, are increasingly turning to psilocybin mushrooms to better cope with the challenges and traumas they face. New organizations like VETS (Veterans Exploring Treatment Solutions) and the Healing Warrior Church of Texas are being organized specifically to meet this burgeoning need.

In the hands of master shamans who first learned of hallucinogens like psilocybin mushrooms, peyote (*Lophophora williamsii*, Cactaceae), and ayahuasca (*Banisteriopsis caapi*, Malpighiaceae), these plants and fungi serve as biological scalpels to reach and sometimes cure afflictions that Western physicians previously could not. With enhanced study and more widespread use of these substances and compounds by Western physicians and other healers, seemingly miraculous results are evermore possible, even within the context of Western society.

Matthew Johnson, PhD, a leading psychiatrist at Johns Hopkins, wrote about psilocybin: “From very ill to very healthy, profound changes to outlook and personality can result from one well-facilitated dose. Patients regularly report that the experience clearly ranks among the most meaningful experiences of their lives, with positive and enduring changes to attitude, behavior, mood, outlook, and spirituality” (oral communication, October 16, 2015).

Ironically, just as we can find, identify, use, and appreciate fungi as never before, they are threatened at an ever-growing rate. Cloud forests, like the Ecuadorean ecosystem in which the new species of psilocybin mush-



Ergot fungus
Claviceps purpurea
Photo ©2024 Steven Foster Group

In the words of Paul Stamets: “Mushrooms are food for the body and medicine for the soul!”

room was collected, are rich in many species of fungi and orchids, but, like most pristine forests in the tropics, besieged by everything from climate change to road-building. Most conservation efforts in equatorial latitudes have focused on large, attractive vertebrates like elephants and primates. Fungi, however, which literally tie the ecosystems together, have long been overlooked. Scientists cannot accurately estimate how many species of fungi exist, with approximations ranging from about one million to more than nine million (oral communication with C. Hobbs, June 15, 2023).

If scientists can still find new species of highly sought-after groups like magic mushrooms, imagine the untapped potential of more obscure species like the ones that yielded cyclosporine or the piri-piri alkaloids. It wasn't until just a few years ago that the first global organization to protect fungi, the Fungi Foundation, was established by Giuliana Furci, the scientist who led the team that cataloged and named *Psilocybe stametsii*.

Nevertheless, fungi remain the least-studied group of organisms with the greatest potential for feeding the hungry, healing the sick, cleaning the environment, and enhancing and augmenting our spiritual practices and well-being.

In the words of Paul Stamets: “Mushrooms are food for the body and medicine for the soul!” (oral communication, May 21, 2022). **HE**

Mark J. Plotkin, PhD, is an ethnobotanist, president of the Amazon Conservation Team, and host of the popular podcast “Plants of the Gods.”

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Porcini mushroom
Boletus edulis
Photo ©2024 Steven Foster Group





By ABC Staff

Editor's note: HerbalGram celebrated its 40th year of publication in summer 2023. As part of the American Botanical Council's (ABC's) yearlong commemoration of this milestone, HerbalGram will include a series of timelines of each of the magazine's first four decades in print. This issue's timeline explores the second decade of HerbalGram — from 1993 to 2003 — and highlights notable articles and other developments. The ABC editorial staff hopes the “40 Years of HerbalGram” series will provide a glimpse into the evolution of ABC's flagship publication and the role it has played and continues to play in the herbal community.

#29 HerbalGram (Spring/Summer 1993)

HerbalGram Happenings

- This issue focuses on “Herbal Safety.”

Article Highlights

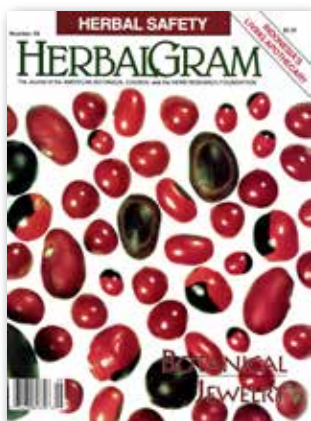
“FDA and Herb Industry Dispute Continues” by Mark Blumenthal

“Feverfew Fever: A Headache for the Consumer”

Dennis Awang, PhD, reviews clinical evidence and clarifies the regulatory status of feverfew (*Tanacetum parthenium*, Asteraceae) after it was approved as a headache treatment in Canada.

“Relative Safety of Herbal Medicines”

Based on a survey of the scientific literature, renowned pharmacognosy professor Norman Farnsworth, PhD, concludes that herbal medicines generally do not present significant safety concerns. At the time, there was considerable debate in the US Congress and the media regarding the safety of popular herbs sold in the United States.



Issue 29



Issue 30

1994

- US Congress passes the Dietary Supplement Health and Education Act of 1994 (DSHEA). This legislation protected many herbal ingredients and products from what some considered inappropriate and irrational regulation as “unapproved drugs” by the US Food and Drug Administration (FDA).

#30 HerbalGram (Winter 1994)

HerbalGram Happenings

- The first 80-page issue of HerbalGram.
- This issue focuses on “European Phytomedicines.”

Article Highlights

“Phytomedicines in Western Europe: Their Potential Impact on Herbal Medicine in the United States”

Varro E. Tyler, PhD, writes that, without a change in US regulatory attitude, phytomedicine developments in Europe may have little impact in the United States. Tyler, a noted pharmacognosy professor and textbook author, was an

expert on the research and regulation of botanicals as nonprescription and prescription medicines in Europe.

“Echinacea: A Literature Review: Botany, History, Chemistry, Pharmacology, Toxicology, and Clinical Uses”

Christopher Hobbs, PhD, presents a 16-page literature review of echinacea (*Echinacea* spp., Asteraceae), his most extensive review to date for *HerbalGram* and one of the most comprehensive reviews of echinacea research published in the United States at that time.

“The Medicinal Plant Stamps of Yugoslavia” by Ira Kennedy

#31 HerbalGram (Summer 1994)

HerbalGram Happenings

- Ginger Hudson-Maffei takes over the art director position from Ira Kennedy, who served as *HerbalGram*'s art director for issues 18/19 through 30.
- The theme of this issue is “Traditional Medicines.”

Article Highlights

“Amla: Traditional Food and Medicine” by Linda Treadway, PhD

“Mexican-American Herbal Remedies: An Evaluation” by Joe S. Graham, PhD

“Tibetan Medical Paintings”

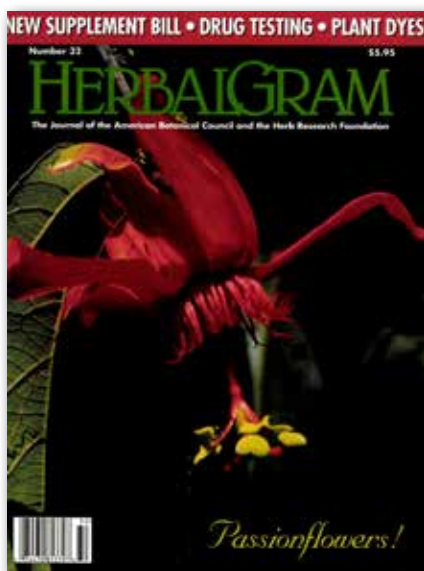
This richly illustrated article by Michael Fallarino, MA, includes beautiful 17th-century paintings that depict medicinal plants used in traditional Tibetan medicine. *HerbalGram* continues to showcase the richness of traditional herbal medicine and art from various cultures.

“Amazing Amazon Medicines: MDs Take Ethnobotanical Tour of Rainforest”

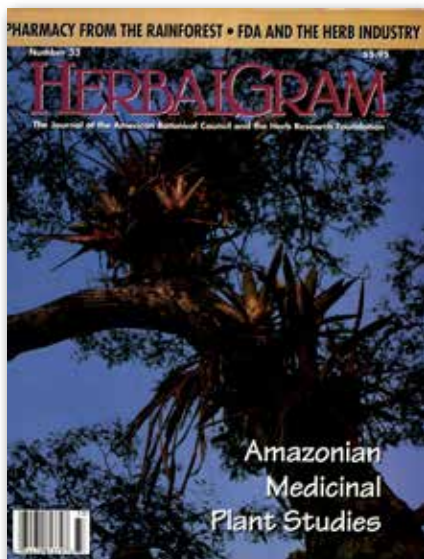
Mark Blumenthal reports on his first ethnobotanical tour of the



Issue 31



Issue 32



Issue 33

Amazon — the model for many future ABC-sponsored ethnobotany tours for professional education credit for pharmacists and physicians.

#32 HerbalGram (Fall 1994)

Article Highlights

“Congress Passes Dietary Supplement Health and Education Act of 1994: Herbs to Be Protected as Supplements”

Mark Blumenthal outlines the details and implications of DSHEA, the newly created regulatory framework for most herbal products sold in the United States.

“Urine Tests for Drug Use: Are They Reliable?”

John P. Morgan, MD, a leading proponent of drug policy reform, describes the potential for false positives on drug tests due to, for example, the consumption of poppy (*Papaver somniferum*, Papaveraceae) seeds.

“Commercial Herb Production: Conservation by Cultivation” by Steven Foster

1995

- ABC announces that its website, www.herbalgram.org, is under development.

#33 HerbalGram (Spring 1995)

HerbalGram Happenings

- This issue includes a special section on “Pharmacy from the Rainforest.”

Article Highlights

“FDA and the Herbal Industry: Problems, Antagonisms and a Possible Solution”

This seminal article by William R. Pendergast, a respected expert in food and drug law, describes the FDA's regulatory challenges related to herbs.

“ABC and HRF Publications Cited in Senate Report on Dietary Supplement Act”

“Green Adventures”

Penny King and Barbara A. Johnston report on ABC’s first co-sponsored trip to the Peruvian Amazon — the nonprofit’s first continuing education ethnobotany ecotour for pharmacists and physicians.

“On the Amazonian Trail of Useful Plants”

Botanist and tree expert Jay Hutchinson explores medicinal and other useful plants in the Peruvian Amazon.

#34 HerbalGram (Summer 1995)

Article Highlights

“Ma Huang: Ancient Herb, Modern Medicine, Regulatory Dilemma”

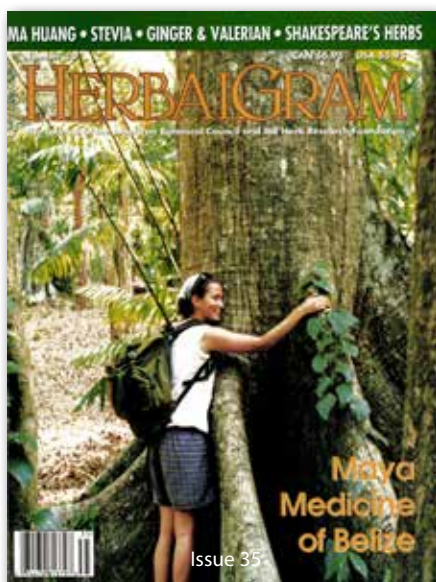
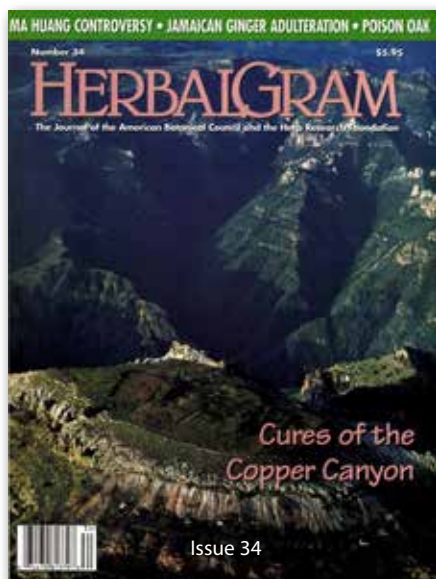
Mark Blumenthal and Penny King review the botany, chemistry, medicinal uses, and safety concerns of ephedra (*Ephedra sinica*, Ephedraceae) and its alkaloids.

“Perspective on Ephedra, Ephedrine, and Caffeine Products” by Rob McCaleb

“The Jamaica Ginger Paralysis Episode of the 1930s”

Medical historian John Parascandola, PhD, recounts a case of ginger (*Zingiber officinale*, Zingiberaceae) extract adulteration that led to “jake leg” paralysis. This historical account is a prime example of a public health issue that resulted from fraud in the marketplace. It gave rise to a series of blues songs about “jake leg,” referring to leg paralysis caused by adulterated “jake,” the Jamaican ginger preparation.

“The European Phytomedicines Market: Figures, Trends, Analyses” by Joerg Gruenwald, PhD



#35 HerbalGram (Fall 1995)

Article Highlights

“FDA Lifts Import Alert on Stevia”

In 1995, the FDA announced that stevia (*Stevia rebaudiana*, Asteraceae) herb can be imported only as a dietary supplement ingredient. In this article, Mark Blumenthal emphasizes the irony that it could be sold as a presumably safe dietary supplement ingredient due to provisions of DSHEA but was considered an unsafe food additive when added to foods in relatively small amounts. (The FDA has permitted the use of highly purified steviol glycosides as food sweeteners since 2008.)

“Medicinal Plants of Shakespeare” by Rosa M. Towne

“The Patenting of Neem: Modern Piracy or Political Correctness”

Barbara A. Johnston writes about attempts by Western businesses to patent products from neem (*Azadirachta indica*, Meliaceae), a traditional plant used widely in India.

“Collecting Experiences: [National Cancer Institute] Plant Collection in Belize” by Penny King



1996

- Varro E. Tyler is elected to the ABC Board of Trustees.

#36 HerbalGram (Spring 1996)

Article Highlights

“The US Botanical Market: An Overview”

Peggy Brevoort provides a comprehensive look at the US botanical market. This article was also printed separately as a nine-page overprint and distributed by ABC at many educational conferences to inform health professionals and others about the growth of the herb market in the United States.

“Mysteries of Rhubarb: Chinese Medicinal Rhubarb Through the Ages”

Clifford M. Foust reviews the history of Chinese rhubarb (*Rheum* spp., Polygonaceae) and its unusual path to European markets.

“Diverse Factors Driving Burgeoning U.S. Tea Industry”

Brian Keating and Mike Razor describe growing sales of various teas in *HerbalGram*'s first tea market report.

#37 HerbalGram (Summer 1996)

HerbalGram Happenings

- This issue focuses on tea (*Camellia sinensis*, Theaceae) and cacao (*Theobroma cacao*, Malvaceae).

Article Highlights

“Chocolate: Past, Present, and Future of Cacao” by Leanna K. Potts

“The Agony of the Ecstasy”

This article, by Mark Blumenthal and Penny King, covers the regulatory and media controversy of an herbal product that supposedly mimicked the effects of the illegal street drug ecstasy (MDMA). Media articles inappropriately used reports of the death of a college student who overdosed on an ephedra-containing “ecstasy” product as a criticism of DSHEA.

“Rediscovering Tea: An Exploration of the Scientific Literature” by Robert L. Gutman, PhD, and Beung-Ho Ryu, PhD

#38 HerbalGram (Fall 1996)

Article Highlights

“One River: Excerpts from the New Book about the Life of Ethnobotanist Richard Evans Schultes”

An excerpt from *One River: Explorations and Discoveries in the Amazon Rain Forest* (Simon and Schuster, 1996) by anthropologist and ethnobotanist Wade Davis, PhD.

“FDA Has Adequate Power and Authority to Protect the Public from Unsafe Dietary Supplements”

Stephen H. McNamara debunks the myth of an unregulated herb and dietary supplement industry. McNamara was a respected Washington, DC-based food and drug attorney and one of the principal architects of DSHEA.



Issue 37

“Ginger as an Anti-nausea Remedy in Pregnancy: The Issue of Safety” by Stephen Fulder, PhD, and Meir Tenne, DSc

1997

- ABC purchases the then-140-year-old Case Mill Homestead in Austin, Texas.
- ABC officially launches its website.
- In its annual Alternative Press Awards, *Utne Reader* lists *HerbalGram* as a finalist in the “Personal Life Coverage” category.

#39 HerbalGram (Spring 1997)

HerbalGram Happenings

- *HerbalGram* adopts a more minimalist layout for departments and feature articles.

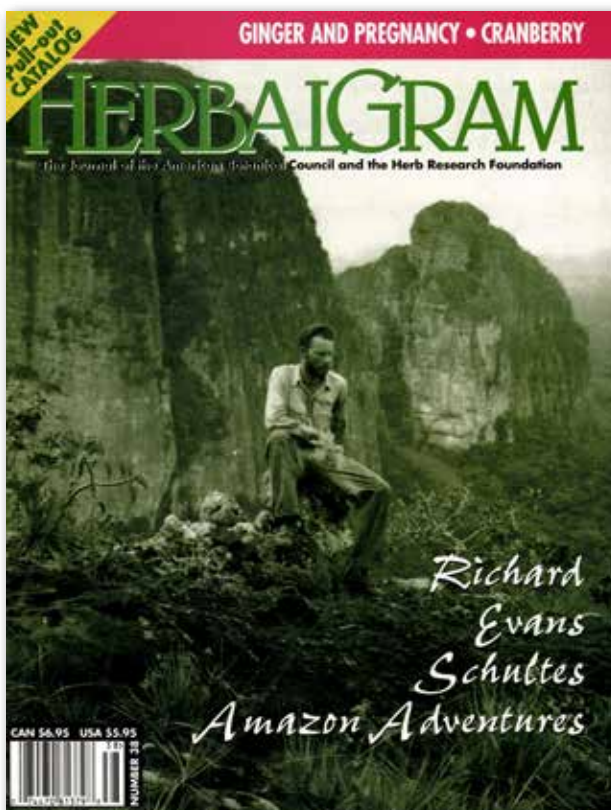
Article Highlights

“Kava: An Overview”

In this 24-page review, Yadhu N. Singh, PhD, and Mark Blumenthal describe the



Issue 39



Issue 38

geographical distribution, mythology, botany, culture, chemistry, and pharmacology of the South Pacific herb kava (*Piper methysticum*, Piperaceae). This cover article helped increase industry awareness of the traditional role and benefits of this revered herb.

“Profile: Great Botanists/Herbalists Series — Henry Hurd Rusby (1855–1940)” by Barbara A. Johnston

#40 HerbalGram (Summer 1997)

HerbalGram Happenings

- *HerbalGram* publishes the first monograph of the newly formed American Herbal Pharmacopoeia (AHP), on St. John’s wort (*Hypericum perforatum*, Hypericaceae).

Article Highlights

“Herbal Monographs” by Mark Blumenthal

“One-Third of Nation’s Adults Use Herbal Remedies: Market Estimated at \$3.24 Billion” by Barbara A. Johnston

“FDA Proposes Warnings and Dose Limits on Ephedra: Government Proposal Comes Three Years After Industry Warning” by Mark Blumenthal

#41 HerbalGram (Fall 1997)

Article Highlights

“President’s Commission on Dietary Supplement Labels Issues Final Report”

Rob McCaleb and Mark Blumenthal analyze the Final Report’s findings, policy guidance, and recommended proposals.



“Herbs and Healing on Nicaragua’s Atlantic Coast”

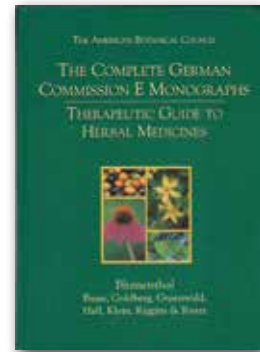
In this extensive article, Bruce Barrett, MD, PhD, discusses the herbs, healers, and history of Nicaragua.

“Turmeric Patent Overturned in Legal Victory” by Barbara A. Johnston and Ginger Webb

Issue 41

1998

- ABC publishes *The Complete German Commission E Monographs*, the nonprofit’s long-awaited translation of the German government expert committee’s (Commission E’s) review of the safety and efficacy of herbal ingredients sold as nonprescription medicines in German pharmacies. ABC’s landmark publication helped legitimize the safety and value of many popular herbs in the eyes of pharmacists, health professionals, the media, members of Congress, and others.



#42 HerbalGram (Spring 1998)

Article Highlights

“A Pictorial History of Herbs in Medicine and Pharmacy”

An excerpt from *Great Moments in Pharmacy: A History of Pharmacy in Pictures* (Parke, Davis & Company, 1966) by George Bender and Robert Thom.

“The Role of Botanical Medicine in 100 Years of American Naturopathy” by Francis Brinker, ND

“ABC Receives Plants Donated by [United States Botanic Garden]” by Gayle Engels

Issue 42



#43 HerbalGram (Summer 1998)

HerbalGram Happenings

- This issue highlights herbal medicine in Africa.

Issue 43



Article Highlights

“Essential Oils of Economic Value in Madagascar: Present State of Knowledge” by Philippe De La Gorce and Philippe Rasoanaivo

“Passing Problems: Prostate and Prunus”

Authors from the International Centre for Research in

Agroforestry, based in Nairobi, Kenya, discuss the harvest, regulation, chemistry, market, cultivation, and conservation of pygeum (*Prunus africana*, Rosaceae) bark.

“Pharmacy on Safari” by Dawnelle Malone

“WHO Acknowledges African Healers” by Barbara A. Johnston

#44 HerbalGram (Fall 1998)

HerbalGram Happenings

- This issue focuses on North American herbs.

Article Highlights

“Botanical ‘Discoveries’ of Lewis and Clark” by Barbara A. Johnston

“The Booming US Botanical Market: A New Overview”

Peggy Brevoort’s second major analysis of the US herb market.

“Medicinal Plant Conservation: A Priority at TRAFIC”

This article, by Christopher S. Robbins, focuses on the need to prioritize worldwide conservation efforts for medicinal plants.

1999

- Michael Balick, PhD, Steven Foster, and Fredi Kronenberg, PhD, join ABC’s Board of Trustees.
- In its annual Alternative Press Awards, *Utne Reader* lists *HerbalGram* as a finalist in the “Science and the Environment” category.

#45 HerbalGram (Winter 1999)

Article Highlights

“Flax: Ancient Herb and Modern Medicine”

William J. Haggerty, PhD, details the history and science of flax (*Linum usitatissimum*, Linaceae).



Issue 44

“Black Cohosh: A Literature Review”

Steven Foster reviews the botany, ethnobotany, and modern scientific research on black cohosh (*Actaea racemosa* syn. *Cimicifuga racemosa*, Ranunculaceae) in a 16-page spread.

“TIME Prints Cover Story on ‘The Herbal Medicine Boom’”

As Betsy Levy explains, *TIME* magazine published a feature article on herbal medicine in 1998 and included images of echinacea, ginkgo (*Ginkgo biloba*, Ginkgoaceae), and St. John’s wort on the cover. *TIME* approached ABC for photographs, which Steven Foster sent to the magazine. *TIME*’s article acknowledged the rapidly increasing awareness of the potential value of herbal dietary supplements.

#46 HerbalGram (Spring 1999)

HerbalGram Happenings

- Natalie Reitinger takes over the art director position from Ginger Hudson-Maffei, who served as *HerbalGram*’s art director for issues 31-45.



Issue 46

Article Highlights

“Medical Journals Report on Herbal and Alternative Medicine”

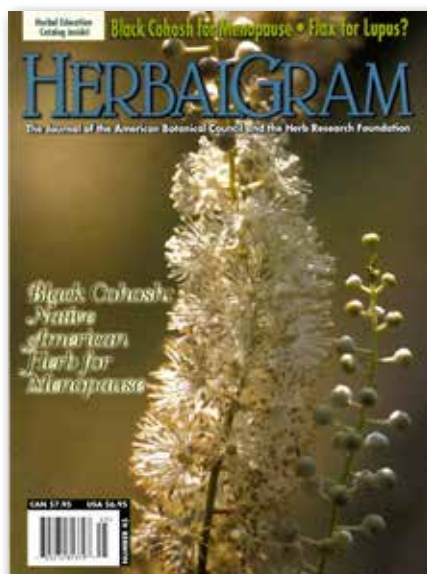
Mark Blumenthal compares recent coverage of herbal and alternative medicine in the *Journal of the American Medical Association* (generally positive) with the *New England Journal of Medicine* (generally negative).

“Variations in Effective Botanical Products”

Francis Brinker, ND, discusses the science of using different preparation types of various botanicals for maximum benefits.

“U.S. and U.N. Studies Support Medicinal Marijuana Research”

Betsy Levy reviews emerging scientific research on cannabis (*Cannabis sativa*, Cannabaceae).



Issue 45

#47 HerbalGram (Fall 1999)

Article Highlights

“Issues in the Commercialization of Medicinal Plants”

Steven R. King, PhD, and colleagues analyze the problems and potential of medicinal plant commercialization with respect to Indigenous rights, intellectual property, and conservation.

“Heavenly Herbs and Earthly Ailments: Africa as Ethnopharmacological Treasury”

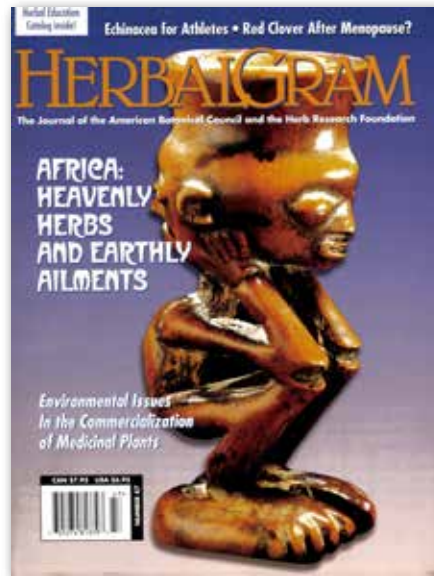
Peter A.G.M. De Smet, PhD, explores an exhibition of ethnopharmacological objects from Sub-Saharan Africa at the Afrika Museum in the Netherlands, replete with photos from his collection.

“DSHEA at Five Years: A Review of Structure-Function Claims”

This article, by Mark Blumenthal and Ed Steele, is one of the first to review the evolution of the limited health-related claims of how herbal dietary supplements can positively affect the structure or function of the body, as legally permitted by DSHEA.

2000

- ABC publishes *Herbal Medicine: Expanded Commission E Monographs*.
- ABC establishes an electronic content licensing program, expanding the reach of its herbal information through other websites. This program allows commercial producers/marketers of botanicals to educate visitors to their websites by incorporating reliable electronic content directly from ABC’s information-rich website.
- ABC initiates peer-reviewed advertising in *HerbalGram*, whereby advertisers are required to substantiate claims made in ads.



#48 HerbalGram (Spring 2000)

Article Highlights

“FDA Issues Final Rules for Structure/Function Claims for Dietary Supplements Under DSHEA”

Loren Israelsen and Mark Blumenthal describe the nuances of permitted structure/function claims under DSHEA.

“Coinage of Greek Cyrenaica, the Silphium Economy, and Exaggerated Advertising”

Henry C. Koerper, PhD, and Daniel E. Moerman, PhD, report on lessons learned from the case of silphium, an exploited Mediterranean plant from North Africa that was known as a contraceptive in the ancient world and popularized on coinage of the time. The presumed extinction of silphium, which is believed to be a species in the genus *Ferula* (Apiaceae), is a cautionary tale of overharvesting. (However, in 2022, researchers in Türkiye found a small population of *Ferula drudeana*, a species that closely corresponds to early descriptions of silphium.)

“Beauty in Peril: The Stoltmann Wilderness” by Suzanne Diamond, MSc

#49 HerbalGram (Summer 2000)

Article Highlights

“Interactions Between Herbs and Conventional Drugs”

In response to concerns raised in medical journals and popular media, Mark Blumenthal provides important background information about herb-drug interactions.

“The Desert Can Heal: Desert Walk for Health, Heritage, and Biodiversity” by Gary Paul Nabhan, PhD

“Tempest in a Tonic Bottle: A Bunch of Weeds?”

An extensive excerpt from Kenny Ausubel’s book *When Healing Becomes a Crime: The Amazing Story of the Hoxsey Cancer Clinics and the Return of Alternative Therapies* (Healing Arts Press, 2000).

“Youngken Herbarium Donated to ABC” by Karen Robin

#50 HerbalGram (Fall 2000)

Issue 50

HerbalGram Happenings

- Karen Robin takes over managing editor position from Barbara A. Johnston, who served as *HerbalGram*’s managing editor for 16 years (since issue 4).



Article Highlights

“Saw Palmetto Gets Strong Public Boost”

Mark Blumenthal reports on a new saw palmetto (*Serenoa repens*, Arecaceae) monograph from the United States Pharmacopeia (USP) and positive comments about the herb from *Consumer Reports*.

“Flor-Essence® Herbal Tonic Use in North America”

Mary Ann Richardson, DrPH, and colleagues review the findings of a National Center for Complementary and Alternative Medicine (NCCAM)-funded study on the use of herbal formulations Flor-Essence and Essiac® by people with cancer.

“Devil’s Claw [*Harpagophytum procumbens*, Pedaliaceae]: From African Traditional Remedy to Modern Analgesic and Anti-inflammatory” by Tankred Wegener

2001

- ABC launches a redesigned website.

#51 HerbalGram (Winter 2001)

Issue 51

HerbalGram Happenings

- Sean Barnes takes over the art director position from Natalie Reitinger, who served as *HerbalGram*’s art director for issues 46-50.



Article Highlights

“From Rudbeckia to Echinacea: The Emergence of the Purple Coneflower in Modern Therapeutics”

Michael Flannery traces the history of echinacea through its modern use.

Fungi expert Paul Stamets contributes two articles on mycology:

- “New Anti-Viral Compounds from Mushrooms”
- “The Ancient Noble Polypore: A Mushroom of Many Mysteries”

“Medicinal Plant Remedies and Nutraceuticals from Ukraine and Georgia” by Tanya Kuritz, PhD, and colleagues

“Mina Jao: A Village Green Pharmacy in Amazonia”

Roger Mustalish, PhD, and Rebecca L. Baxter profile a “green pharmacy” in Sucusari in the Peruvian Amazon.

#52 HerbalGram (Spring 2001)

HerbalGram Happenings

Issue 52

- Much of this issue is dedicated to ABC’s Ginseng Evaluation Program (GEP).

Article Highlights

“An Introduction to the Ginseng Evaluation Program”

Dennis Awang, PhD, Mark Blumenthal, and colleagues describe the first phase of the GEP, in which two university laboratories developed and validated testing methodologies and analyzed more than 500 commercial products that were labeled as “ginseng” (*Panax* spp., Araliaceae) and sold in North America.

“Vietnamese Ginseng: A Rare Species of *Panax*” by Steven Foster

“New FDA Advisory and AHPA Trade Recommendation on *Aristolochia*” by Karen Robin

“Richard Evans Schultes: 1915–2001”

Karen Robin explores the life and legacy of Schultes, a Harvard ethnobotanist and the so-called “Father of 20th-Century Ethnobotany.”





#53 HerbalGram (Summer 2001)

HerbalGram Happenings

- ABC publishes the last issue of *HerbalGram* produced in conjunction with the Herb Research Foundation.

Article Highlights

“Manuka: The Good Oil from New Zealand”

Noel Porter, PhD, profiles manuka (*Leptospermum scoparium*, Myrtaceae), a native New Zealand plant.

“Standardized Extracts: Neither Poison nor Panacea”

Australian herbalist and author Kerry Bone outlines the benefits and drawbacks of chemically standardized extracts.

“FTC Cracking Down on Internet Claims”

Mark Blumenthal addresses early government attempts to curtail misinformation touted by marketers of herbal products on the internet.

“A Closer Look: Secretory Structures of Aromatic and Medicinal Plants”

Katerina P. Svoboda, PhD, and colleagues share an excerpt and electron microscopy photographs from *Secretory Structures of Aromatic and Medicinal Plants* (Microscopix, 2000).

“Issues of Quality: Analyzing Herbal Materials and the Current Status of Methods Validation”

American Herbal Products Association (AHPA) President Michael McGuffin discusses efforts to validate analytical methods for the challenging task of botanical quality control.

2002

- ABC makes HerbClip and *HerbalGram* available online.
- ABC receives North American Precis Syndicate Certificate of Excellence for Superior Achievement in Media Relations.

#54 HerbalGram (Spring 2002)

HerbalGram Happenings

- First issue published solely by the American Botanical Council.

Article Highlights

“Herbal Medicine at the Crossroads: The Challenge of the 21st Century”

This article is an edited transcript of a presentation that Varro E. Tyler gave in 2001, shortly before he died. It also includes remembrances from Tyler’s friends and colleagues.

“The Nature of Ginseng”

Subhuti Dharmananda, PhD, writes about the traditional use and modern research on Asian ginseng (*Panax ginseng*, Araliaceae).

“Novel Antimicrobials from Mushrooms” by Paul Stamets

“Ice Man’s Medicine Kit” by Barbara A. Johnston

#55 HerbalGram (Summer 2002)

Article Highlights

“The Patterson Bundle: An Herbalist’s Discoveries in a 500-Year-Old Native American Bundle” by Merry Lycett Harrison

“Herbal Dietary Supplements and Foods: Product Liability Analysis for a ‘Failure to Warn’ of Herb/Drug Interactions and Guidelines to Develop Appropriate Warnings” by Paul D. Rubin

“Kava Safety Questioned Due to Case Reports of Liver Toxicity”

Mark Blumenthal presents expert analyses of case reports that had insufficient evidence to determine causation.

Issue 54



Issue 55



“Dilemmas of Traditional Botanical Research” by Eric Yarnell, ND, and Kathy Abascal

#56 HerbalGram (Fall 2002)

Issue 56

HerbalGram Happenings

- *HerbalGram* introduces departments with specific color themes.

Article Highlights

“White House Commission on Complementary and Alternative Medicine Policy Issues Final Report” by Hannah V. Bradford

“Farm Bill Bans Use of Name ‘Ginseng’ on Non-*Panax* Species”

As Mark Blumenthal explains, the bill requires *Eleutherococcus senticosus* (Araliaceae) to be called “eleuthero” in the US herb trade, not “Siberian ginseng.” Also, the common name “ginseng” may be used only for *Panax* species.

“*Rhodiola rosea*: A Phytomedicinal Overview”

In this cover article, Richard P. Brown, MD, Patricia Gerbarg, MD, and Zakir Ramazanov, PhD, review the science and history of *Rhodiola rosea* (Crassulaceae).

“Review of Medicinal Mushrooms Advances: Good News from Old Allies”

Fungi expert Solomon P. Wasser, PhD, discusses new science in the emerging field of medicinal mushrooms.

2003

- ABC debuts *The ABC Clinical Guide to Herbs* as a reference book and continuing education module.
- Peggy Brevoort, Tom Kurt, MD, and Morris Shriftman join ABC’s Board of Trustees.

#57 HerbalGram (Winter 2003)

Issue 57

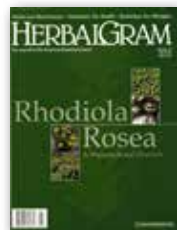
Article Highlights

“USP Establishes Botanical Advisory Panel” by Mark Blumenthal

“What in the Name of *Panax* Are Those Other ‘Ginsengs?’”

Dennis Awang explores the etymology and occasional confusion of the common name “ginseng.”

“Herb Day USA: A Good Day for Herbal Medicine” by Aviva Romm, MD



“European Union Passes Traditional Herbal Medicines Directive”

The European Union creates a new regulatory category for herbal medicines, the relative safety of which is based on their traditional use, as Mark Blumenthal explains in this article.

#58 HerbalGram (Spring 2003)

Article Highlights

“Backyard Ben Cao: A Photo Essay of Chinese Herbs Grown in American Gardens” by Steven Foster

“Ceremonial Peyote Use and its Antiquity in the Southern United States” by Peter A.G.M. De Smet, PhD, and Jan G. Bruhn, PhD

“Doctoral Programs in Acupuncture and Oriental Medicine Launched” by Sarah Jackson

“Some Arguments against the Standardization of Herbalists”

In this guest editorial, Stephen Harrod Buhner argues against standardizing professional herbalist practice.



Issue 58

#59 HerbalGram (Summer 2003)

Article Highlights

“Industry Increasingly Nervous about Drug Orientation of FDA’s Proposed GMPs for Dietary Supplements”

Mark Blumenthal describes industry hesitation about proposed good manufacturing practices (GMPs) and notes that the high costs threaten smaller companies.

“Using Cultural Items for Science Is No Longer Acceptable: Objections to ‘The Patterson Bundle’”

In a guest commentary, Cindy Bloom discusses why collections of native spiritual objects for intellectual pursuits are unacceptable.

“Rooibos Tea: Research into Antioxidant and Antimutagenic Properties”

Laurie Erickson, MS, reviews research on antioxidant and antimutagenic activity of South Africa’s rooibos (*Aspalathus linearis*, Fabaceae) tea.

“The Slow Demise of FDA Censorship” by Jonathan W. Emord MD



Issue 59

Thanks for supporting ABC’s nonprofit mission! Keep a lookout for Part 3 (2003–2013) of the “40 Years of *HerbalGram*” series, coming in *HerbalGram* issue 140.

US Sales of Herbal Supplements Decline Slightly in 2022

Despite 1.9% drop in sales — the first sales decrease in nearly 20 years — US consumers continue to prioritize supplements to support digestive health, energy levels, and ‘foundational’ wellness

By Tyler Smith,^a Hannah Bauman,^a Haleigh Resetar,^b and Erika Craft^c

^a American Botanical Council (Austin, Texas)

^b SPINS (Chicago, Illinois)

^c *Nutrition Business Journal* (Boulder, Colorado)

INTRODUCTION

In 2022, retail sales of herbal dietary supplements in the United States totaled an estimated \$12.121 billion — a slight decrease from 2021, according to the *Nutrition Business Journal* (NBJ). Consumers spent \$229 million, or 1.9%, less on these products in 2022 than in the previous year. This is the first time in nearly two decades that annual sales of herbal supplements have declined. In 2002 and 2003, annual sales decreased by 2.8% and 2.3%, respectively, but sales have increased steadily since then (Table 1). Despite the recent decline, 2022 is the third consecutive year in which annual sales of herbal supplements exceeded \$10 billion.

SPINS, a market research firm based in Chicago, Illinois, and NBJ, a natural products industry publication of Informa’s New Hope Network based in Boulder, Colorado, provided the US retail sales figures for this report. NBJ supplied estimates of the total annual sales of herbal supplements, as well as sales in three market channels (mass market; natural, health food, and specialty; and direct sales) and sales by product type (single-herb supplements vs. combination formulas). SPINS provided sales data for the 40 top-selling herbal and fungal ingredients in the mainstream (conventional) and natural retail channels. Channel definitions are included in Table 2.

According to NBJ, mass market sales increased by 6.5% in 2022 to an estimated \$2.350 billion (Table 3). Consumer spending in NBJ’s natural, health food, and specialty channel remained roughly the same as in 2021 but decreased slightly — for the first time since 2009 — by 0.3%, with sales totaling \$2.984 billion. Direct sales of herbal supplements, which will be discussed later in this report, experienced the most significant sales decline of 5.1% and totaled \$6.788 billion.

The SPINS data for the ingredients discussed in this report include sales of dietary supplements in which the herbal or fungal ingredient (or derivative thereof, such as quercetin, etc.) is the primary functional ingredient. This includes only products that meet the legal definition of a dietary supplement per the US Food and Drug Administration (FDA), except for cannabidiol (CBD) products. Sales of herbal teas or cosmetics with botanical ingredients are not included. The dollar amounts are estimates of the total sales during the 52-week period that ended January 2, 2023. The mainstream and natural channel sales discussed in this report refer to retail sales in the United States only.

MAINSTREAM CHANNEL

Psyllium

Psyllium (*Plantago ovata*, Plantaginaceae) was the top-selling herbal supplement ingredient in US mainstream retail outlets in 2022. Consumers spent \$269,602,688 on psyllium-containing supplements in 2022 — a 9.8% increase in sales from the previous year. Previously, in 2020 and 2021, elder berry (*Sambu-*

Table 1. Total US Retail Sales of Herbal Supplements*

Year	Total Sales	% Change
2022	\$12.121 billion	-1.9%
2021	\$12.350 billion	9.7%
2020	\$11.261 billion	17.3%
2019	\$9.602 billion	8.6%
2018	\$8.842 billion	9.4%
2017	\$8.085 billion	8.5%
2016	\$7.452 billion	7.7%
2015	\$6.922 billion	7.5%
2014	\$6.441 billion	6.8%
2013	\$6.033 billion	7.9%
2012	\$5.593 billion	5.5%
2011	\$5.302 billion	4.5%
2010	\$5.049 billion	3.3%
2009	\$5.037 billion	5.0%
2008	\$4.800 billion	1.0%
2007	\$4.756 billion	4.4%
2006	\$4.558 billion	4.1%
2005	\$4.378 billion	2.1%
2004	\$4.288 billion	3.4%
2003	\$4.146 billion	-2.3%
2002	\$4.275 billion	-2.8%
2001	\$4.361 billion	3.2%
2000	\$4.225 billion	2.9%

Source: *Nutrition Business Journal* (NBJ)

* Includes sales in all channels. NBJ primary research includes NBJ surveys of supplement manufacturers, distributors, MLM firms, mail order, internet, and raw material and ingredient supply companies, as well as interviews with major retailers (Walmart, Costco, etc.), manufacturers, suppliers, and industry experts. Secondary sources include IRI, SPINSScan Natural, Nielsen, *Natural Foods Merchandiser*, Insight, The Hartman Group, company data, and other published material.

Psyllium
Plantago ovata

Photo ©2024 Steven Foster Group

Also known as ispaghula, psyllium has been used medicinally for millennia in traditional Chinese medicine (TCM), Ayurveda, and traditional Persian medicine for blood pressure regulation and to treat constipation, diarrhea, and dermatological issues, among others.

Table 2. US Retail Channel Definitions*

	SPINS	<i>Nutrition Business Journal</i>
Mainstream Retail Channels	Multi-Outlet Channel (powered by IRI) Covers grocery outlets (stores with \$2 million+ total annual sales), drug outlets (chains and independent stores, excluding prescription sales), and selected retailers across mass merchandisers, including Walmart, club, dollar, and military stores representing more than 105,000 retail locations.	Mass Market Channel Includes food/grocery, drug, mass merchandise, and club and convenience stores (e.g., Walmart, Costco, etc.).
Natural Retail Channels	Natural Enhanced Channel Includes full-format stores with \$2 million+ in annual sales and 40% or more of UPC-coded sales from natural/organic/specialty products. It includes co-ops, associations, independents, and large regional chains (excluding Whole Foods Market and Trader Joe's). This channel represents more than \$28 billion in total sales and encompasses more than 1,850 stores.	Natural, Health Food, and Specialty Channel Includes supplement and specialty retail outlets, including Whole Foods Market (estimates), GNC, sports nutrition stores, etc.
Direct Sales		Includes direct-to-consumer sales from the internet (e.g., e-commerce websites such as Amazon.com and Walmart.com, among many others), direct-selling media (TV, radio, and print publications), health practitioners, and multilevel marketing (MLM) or network marketing firms (US sales only).

* The sales discussed in this article pertain to those involving herbal, fungal, and related dietary supplements. They generally do not include herbs sold as teas and beverages, as ingredients in conventional foods, or as ingredients in natural personal care and cosmetic products.

cus nigra, Viburnaceae) ranked first in mainstream sales during the first two years of the COVID-19 pandemic.

Also known as ispaghula, psyllium has been used medicinally for millennia in traditional Chinese medicine (TCM), Ayurveda, and traditional Persian medicine for blood pressure regulation and to treat constipation, diarrhea, and dermatological issues, among others.¹ The common names psyllium and ispaghula derive from references to the size or shape of the plant's seeds: psyllium from the Greek *psyllos*, meaning "flea," and the Persian words *isap* and *ghol*, meaning "horse" and "ear."^{1,2}

Each psyllium plant can produce thousands of these flea-size seeds, which are prized for their mucilaginous (gel-forming) properties. The seeds and seed husks (coverings) contain high amounts of soluble and insoluble fiber and are the primary plant materials used in commercial products. One teaspoon of ground psyllium husk, for example, contains almost eight times more soluble fiber by weight than oat (*Avena sativa*, Poaceae) bran. Psyllium is also considered a prebiotic — a term that refers to substances that promote the growth of beneficial microorganisms in the digestive tract.^{2,3} A diet high in fiber also is associated with reduced incidence of, and mortality caused by, cardiovascular disease, most likely through fiber's beneficial effects on low-density lipoprotein (LDL) cholesterol and total cholesterol levels.⁴

Given these properties, psyllium is used commonly as an ingredient in dietary supplements marketed for digestive and cardiovascular health. In 2022, approximately 69% of psyllium-containing supplements sold in mainstream retail outlets were labeled to support cardiovascular health, according to SPINS data. Among dietary supplements in the cardiovascular health category, psyllium was the top-selling ingredient in 2022.⁵ Digestive health was the next most common health focus of psyllium supplements sold in the mainstream channel in 2022 (about 21%), followed by non-specific health focuses (roughly 6%).

The US Food and Drug Administration (FDA) considers psyllium a dietary supplement ingredient, but the FDA has also approved psyllium as an ingredient in some over-the-counter (OTC) drug products (e.g., OTC bulk laxative drug products), which are subject to a separate regulatory process.^{3,6,7} The SPINS data in this report include sales of psyllium products marketed as dietary supplements only.

Elder berry
Sambucus nigra
Photo ©2024 Steven Foster Group



Table 3. Total Herbal Supplement Sales in US by Retail Channel

	2015	2016	2017	2018	2019	2020	2021	2022	% Change from 2021
Mass Market	\$1.204 billion	\$1.336 billion	\$1.449 billion	\$1.558 billion	\$1.704 billion	\$2.131 billion	\$2.205 billion	\$2.350 billion	6.5%
Natural, Health Food, and Specialty	\$2.356 billion	\$2.506 billion	\$2.624 billion	\$2.804 billion	\$2.904 billion	\$2.950 billion	\$2.992 billion	\$2.984 billion	-0.3%
Direct Sales	\$3.363 billion	\$3.609 billion	\$4.012 billion	\$4.480 billion	\$4.995 billion	\$6.179 billion	\$7.152 billion	\$6.788 billion	-5.1%

Source: Nutrition Business Journal

Table 4. Top-Selling Herbal Supplements in 2022 — US Mainstream Multi-Outlet Channel

Rank	Primary Ingredient	Latin Binomial	Total Sales	% Change from 2021
1	Psyllium ^a	<i>Plantago ovata</i>	\$269,602,688	9.8%
2	Elder berry	<i>Sambucus nigra</i> and <i>S. canadensis</i>	\$236,225,467	-14.5%
3	Apple cider vinegar	<i>Malus</i> spp.	\$126,354,425	-26.4%
4	Turmeric ^b	<i>Curcuma longa</i>	\$123,070,707	6.9%
5	Ashwagandha	<i>Withania somnifera</i>	\$110,971,467	20.1%
6	Cranberry	<i>Vaccinium macrocarpon</i>	\$91,471,972	-1.9%
7	Ivy leaf	<i>Hedera helix</i>	\$49,773,754	-1.6%
8	Fenugreek	<i>Trigonella foenum-graecum</i>	\$43,162,559	-6.0%
9	Echinacea ^c	<i>Echinacea</i> spp.	\$41,986,186	5.1%
10	Ginger	<i>Zingiber officinale</i>	\$40,780,915	-2.1%
11	Beet root	<i>Beta vulgaris</i>	\$31,261,474	52.4%
12	St. John's wort	<i>Hypericum perforatum</i>	\$28,905,466	-11.5%
13	Maca	<i>Lepidium meyenii</i>	\$28,231,883	64.9%
14	Garlic	<i>Allium sativum</i>	\$27,753,977	-17.8%
15	Wheatgrass / Barley grass	<i>Triticum aestivum</i> / <i>Hordeum vulgare</i>	\$25,977,536	-0.6%
16	Ginkgo	<i>Ginkgo biloba</i>	\$25,261,645	-10.2%
17	Saw palmetto	<i>Serenoa repens</i>	\$22,579,760	-13.8%
18	Flax seed / Flax oil	<i>Linum usitatissimum</i>	\$21,115,112	-6.5%
19	Black cohosh	<i>Actaea racemosa</i>	\$20,906,223	-11.9%
20	Valerian	<i>Valeriana officinalis</i>	\$20,858,624	-16.4%
21	Guarana	<i>Paullinia cupana</i>	\$20,798,795	107.0%
22	Aloe	<i>Aloe vera</i>	\$18,956,755	5.1%
23	Milk thistle	<i>Silybum marianum</i>	\$18,938,572	-0.0%
24	Pumpkin	<i>Cucurbita pepo</i>	\$18,887,748	-3.8%
25	Cinnamon	<i>Cinnamomum</i> spp.	\$17,159,879	41.9%
26	Goji berry	<i>Lycium</i> spp.	\$16,708,327	-12.7%
27	Yohimbe	<i>Pausinystalia johimbe</i>	\$16,460,966	-8.1%
28	Horny goat weed	<i>Epimedium</i> spp.	\$15,451,919	-5.1%
29	Cannabidiol (CBD)	<i>Cannabis sativa</i>	\$14,045,209	-29.3%
30	Red yeast rice ^d	<i>Oryza sativa</i>	\$12,952,243	-3.2%
31	Açaí	<i>Euterpe oleracea</i>	\$11,075,960	6.9%
32	Fennel	<i>Foeniculum vulgare</i>	\$10,673,036	-10.0%
33	Senna ^e	<i>Senna alexandrina</i>	\$10,391,488	-15.6%
34	Rhubarb	<i>Rheum</i> spp.	\$9,740,469	-9.2%
35	Spirulina / Blue-green algae ^f	<i>Arthrospira platensis</i> and <i>A. maxima</i> / —	\$9,442,813	123.1%
36	Rhodiola	<i>Rhodiola</i> spp.	\$9,274,188	1.5%
37	Green coffee extract	<i>Coffea arabica</i>	\$7,858,803	-39.8%
38	Dandelion	<i>Taraxacum officinale</i>	\$7,709,063	62.0%
39	Chamomile	<i>Matricaria chamomilla</i> syn. <i>M. recutita</i>	\$7,445,225	-36.7%
40	Ginseng	<i>Panax</i> spp.	\$7,130,572	-23.6%

Source: SPINS (52 weeks ending January 2, 2023)

^a Excludes over-the-counter (OTC) drugs containing psyllium.

^b Includes standardized turmeric extracts with high levels of curcumin.

^c Includes three *Echinacea* species: *E. angustifolia*, *E. pallida*, and *E. purpurea*.

^d Red yeast rice is fermented with the yeast *Monascus purpureus*.

^e Excludes OTC laxative drugs containing senna or sennosides.

^f Blue-green algae belong to the phylum Cyanobacteria.

Table 5. Top-Selling Herbal Supplements in 2022 — US Natural Channel

Rank	Primary Ingredient	Latin Binomial	Total Sales	% Change from 2021
1	Turmeric ^a	<i>Curcuma longa</i>	\$35,786,281	-9.4%
2	Cannabidiol (CBD)	<i>Cannabis sativa</i>	\$33,668,215	-15.3%
3	Elder berry	<i>Sambucus nigra</i> and <i>S. canadensis</i>	\$28,876,798	-11.5%
4	Wheatgrass / Barley grass	<i>Triticum aestivum</i> / <i>Hordeum vulgare</i>	\$18,420,564	-10.5%
5	Ashwagandha	<i>Withania somnifera</i>	\$17,663,851	-1.3%
6	Quercetin ^b	—	\$16,675,366	3.3%
7	Mushrooms (other)	—	\$15,575,485	11.2%
8	Aloe	<i>Aloe vera</i>	\$13,362,915	0.9%
9	Psyllium ^c	<i>Plantago ovata</i>	\$10,571,193	6.4%
10	Milk thistle	<i>Silybum marianum</i>	\$10,417,325	-1.0%
11	Flax seed / Flax oil	<i>Linum usitatissimum</i>	\$10,243,649	-8.9%
12	Oregano ^d	<i>Origanum vulgare</i>	\$10,174,550	5.6%
13	Echinacea ^e	<i>Echinacea</i> spp.	\$9,047,270	11.5%
14	Beet root	<i>Beta vulgaris</i>	\$7,972,045	42.8%
15	Saw palmetto	<i>Serenoa repens</i>	\$7,858,890	0.2%
16	Cranberry	<i>Vaccinium macrocarpon</i>	\$7,699,307	-2.5%
17	Maca	<i>Lepidium meyenii</i>	\$6,720,405	-4.2%
18	Spirulina / Blue-green algae ^f	<i>Arthrospira platensis</i> and <i>A. maxima</i> / —	\$6,708,965	15.8%
19	Garlic	<i>Allium sativum</i>	\$6,615,981	-4.8%
20	Valerian	<i>Valeriana officinalis</i>	\$6,537,924	-4.7%
21	Chlorophyll / Chlorella	— / <i>Chlorella vulgaris</i>	\$6,236,487	-20.2%
22	Nigella	<i>Nigella sativa</i>	\$6,178,587	2.4%
23	Algae (other)	—	\$5,876,448	25.6%
24	Ginkgo	<i>Ginkgo biloba</i>	\$5,117,797	-3.4%
25	Echinacea-goldenseal combo	<i>Echinacea</i> spp. / <i>Hydrastis canadensis</i>	\$5,076,548	5.4%
26	Reishi mushroom	<i>Ganoderma lucidum</i>	\$4,903,641	2.3%
27	Apple cider vinegar	<i>Malus</i> spp.	\$4,435,659	-45.1%
28	Cordyceps mushroom	<i>Cordyceps</i> spp.	\$4,256,857	9.5%
29	Barberry	<i>Berberis vulgaris</i>	\$4,129,216	19.6%
30	Kava	<i>Piper methysticum</i>	\$3,947,180	13.2%
31	Horsetail	<i>Equisetum</i> spp.	\$3,937,823	-9.6%
32	Resveratrol ^g	—	\$3,785,523	13.8%
33	Papaya	<i>Carica papaya</i>	\$3,668,714	0.5%
34	Cherry	<i>Prunus</i> spp.	\$3,546,706	3.2%
35	Red yeast rice ^h	<i>Oryza sativa</i>	\$3,486,807	-0.8%
36	Bacopa	<i>Bacopa monnieri</i>	\$3,463,210	18.9%
37	Fenugreek	<i>Trigonella foenum-graecum</i>	\$3,360,465	7.3%
38	Ginger	<i>Zingiber officinale</i>	\$3,245,662	3.6%
39	Hawthorn	<i>Crataegus</i> spp.	\$3,158,834	2.3%
40	Kelp ⁱ	—	\$3,154,282	6.0%

Source: SPINS (52 weeks ending January 2, 2023)

^a Includes standardized turmeric extracts with high levels of curcumin.

^b Quercetin is a flavonoid found in various plants, such as onions (*Allium sepa*) and berries.

^c Excludes over-the-counter (OTC) drugs containing psyllium.

^d Includes products labeled as containing oregano oil and oregano leaf tinctures.

^e Includes three *Echinacea* species: *E. angustifolia*, *E. pallida*, and *E. purpurea*.

^f Blue-green algae belong to the phylum Cyanobacteria.

^g Resveratrol is an antioxidant found in various plants, such as grapes (*Vitis vinifera*) and berries.

^h Red yeast rice is fermented with the yeast *Monascus purpureus*.

ⁱ Kelp species belong to the order Laminariales.

The potential health benefits of psyllium husks have been investigated in an increasing number of human clinical trials. A systematic review published in 2020 examined the effects of psyllium on blood pressure in people with hypertension. The review, which included 11 clinical trials with 592 total participants, found that psyllium supplementation was associated with a significant reduction in systolic blood pressure, with greater effects observed in those with higher baseline blood pressure. The authors concluded: “Given the overarching benefits and lack of reported side effects, ... health care providers should consider the use of psyllium supplementation for the treatment or abatement of hypertension.”⁸ Similarly, a systematic review published in 2018 found that psyllium husk supplementation had modest but significant effects on both systolic and diastolic blood pressure.⁹

A separate systematic review and meta-analysis published in 2020 examined the effects of psyllium on lipid profiles, glucose metabolism, and body weight in people with diabetes. The authors reviewed eight studies with 395 total participants and found significant reductions in triglycerides, LDL cholesterol, fasting blood sugar, and hemoglobin A1c in those who consumed psyllium.¹⁰

The effects of fiber on digestive health have been investigated widely. A 2022 systematic review and meta-analysis assessed the effects of seven types of fiber, including psyllium, wheat (*Triticum aestivum*, Poaceae) bran, inulin, pectin, and others, on chronic constipation in adults. The review included 16 randomized, controlled clinical trials with 1,251 total participants. The authors determined that psyllium had positive effects on stool consistency and severity of straining, and was as effective or more effective than osmotic and stimulant laxatives in improving bowel movement frequency. Of all the fiber types investigated, they concluded that psyllium husk was the most effective at providing constipation relief, particularly at dosages greater than 10 grams per day. The study “highlights psyllium’s potential to be used as a first-line strategy for the management of constipation,” the authors concluded.¹¹

The potential weight loss benefits of psyllium also have been investigated, although psyllium supplements marketed for this purpose accounted for less than 1% of psyllium supplements sold in the 2022 mainstream channel, according to SPINS data. Most recently, a meta-analysis published in 2023, which reviewed the results of six clinical trials with 354 total participants, found that psyllium consumed



Guarana
Paullinia cupana
Photo ©2024 Steven Foster Group



Ashwagandha
Withania somnifera
Photo ©2024 Steven Foster Group



Goji berry
Lycium sp.
Photo ©2024 Steven Foster Group



Ginger
Zingiber officinale
Photo ©2024 Steven Foster Group



Aloe
Aloe vera
Photo ©2024 Steven Foster Group

immediately before meals “was effective for decreasing body weight, [body mass index, BMI], and waist circumference in overweight and obese populations.”¹²

Consumer interest in digestive health products has grown over the past decade, particularly since 2020, as pandemic-related dietary and lifestyle changes (e.g., reduced physical activity, increased alcohol consumption) led to an increase in gastrointestinal complaints for some. According to a survey by the market research company FMCG Gurus, 79% of respondents in 2022 recognized the connection between digestive and overall health, an increase of 10 percentage points since 2018.¹³ The increased importance of digestive health is reflected in the 2022 sales data for psyllium: From 2021 to 2022, sales of psyllium supplements marketed for digestive health grew by 12.5%, according to SPINS.

Consumers also increasingly understand the importance of the microbiome and the connection between the digestive system and the central nervous system (the so-called “gut-brain axis”). Still, only a minority of consumers appear to be aware of the differences between probiotics and prebiotics and related terms such as postbiotics (substances that are released by, or produced through, the metabolic activity of probiotics and have beneficial effects) and synbiotics (supplements that combine both prebiotics and probiotics). According to *Nutritional Outlook*, marketing products specifically for microbiome benefits and as prebiotics is a relatively recent trend, and one that is expected to continue.^{5,14}

Notable Sales Increases

Spirulina

Of the 40 top-selling ingredients in the mainstream channel, spirulina (*Arthrospira* spp., Microcoleaceae) supplements had the highest percentage sales growth in 2022, with sales more than doubling from 2021. Mainstream sales of spirulina totaled \$9,442,813 in 2022, an increase of 123.1% from the previous year. Spirulina supplements were not ranked in the top 40 in 2021, but the more-than-\$5.2 million sales increase in 2022 made it the 35th top-selling supplement in this channel. This is the first time in at least 10 years that spirulina supplements have appeared on the top 40 mainstream list. In 2012, with annual sales of \$506,504, the ingredient ranked 25th in sales in this channel.¹⁵ Spirulina is more frequently a top-seller in natural retail outlets and has ranked among the top 10 ingredients in that channel at least four times since 2010.

Technically, spirulina is neither a plant nor a fungus. It belongs to the taxonomic phylum Cyanobacteria, which includes prokaryotes (single-celled organisms without a nucleus) that produce food through photosynthesis. Cyanobacteria can be found in extreme environments around the world and are also known as “blue-green algae,” although scientifically, they typically are not classified as algae. According to some sources, cyanobacteria are believed to be responsible for up to a quarter of global carbon fixation, the process through which living organisms convert atmo-

spheric carbon to organic compounds.¹⁶ (SPINS groups sales of spirulina supplements, unspecified blue-green algae supplements, and combinations thereof in the same category.)

Spirulina belongs to the genus *Arthrospira*, formerly known as *Spirulina*, which contains more than 30 species that have a characteristic helix, or spiral, shape (hence the genus name). Spirulina thrives in alkaline, mineral-rich lakes, and the organism can be found in large quantities in Central Africa’s Lake Chad and east Africa’s Great Rift Valley, for example.¹⁷

Although people in Mexico, Central America, and parts of Africa have used spirulina as food for centuries, it gained popularity as a dietary supplement ingredient in the United States in the late 1970s.^{18,19} The species that are used most commonly in spirulina dietary supplements are *A. platensis* and *A. maxima*, which are rich in protein (up to 70% by weight) and contain an array of nutrients, including vitamins (e.g., beta-carotene, B₁, B₂, B₁₂, and E), minerals (e.g., iron, magnesium, calcium, phosphorus, and zinc), essential fatty acids (e.g., linolenic acid), phenolic compounds, biopeptides, and enzymes. Spirulina also contains chlorophyll, carotenoids, and phycocyanin, a blue pigment that commonly is used as a natural colorant in foods and cosmetics.^{19,20}

Compounds found in spirulina have demonstrated immunomodulatory, antioxidant, anti-inflammatory, anti-tumor, antimicrobial, and other effects in laboratory studies.²⁰ Its complex chemical and nutrient profile has led to a wide range of potential claimed health benefits, but it may be most commonly used as a protein and general nutrition supplement.¹⁸ At the United Nations’ World Food Conference in 1974, spirulina was even praised as “the best food for the future.”¹⁷

Researchers have investigated the effects of spirulina supplementation on a wide range of conditions, including Alzheimer’s disease, attention deficit hyperactivity disorder (ADHD), COVID-19, HIV, male infertility, mental fatigue, and many others.¹⁹ Recently, several systematic reviews have been conducted to summarize the potential benefits of spirulina in a few well-studied areas, including cardiovascular health, sports performance, and weight loss. At least three systematic reviews and meta-analyses published from 2021 to 2023 reported significant positive effects on systolic and diastolic blood pressure,²¹ lipid profiles (e.g., total cholesterol, LDL and high-density lipoprotein [HDL] cholesterol),²² and biomarkers of glycemic control (e.g., fasting blood glucose and triglycerides) in people with diabetes.²³

Researchers also have published at least two recent reviews of spirulina’s effects on sports performance, with mixed results. The authors of a 2022 systematic review reported potential benefits for submaximal endurance exercise by increasing oxygen uptake but found that spirulina did not have any significant effects on physical performance in “power athletes.”²⁴ A meta-analysis published in 2023 reported negative effects on high-intensity rowing performance.²⁵

Results of clinical trials on spirulina's effects on anthropometric indices (e.g., body weight, BMI) appear to be more promising, according to two recent reviews. A systematic review published in 2020 found that spirulina had "ameliorative effects" on body weight, waist circumference, and BMI in studies that lasted at least 12 weeks.²⁶ In a separate systematic review from 2023, researchers reported significant effects of spirulina on body weight with "high certainty of evidence."²⁷

Despite the body of research on spirulina's potential benefits for some conditions, approximately 58% of spirulina supplements sold in mainstream retail outlets in 2022 were marketed for a non-specific health focus. Sales of spirulina supplements in this category grew by more than 300% from the previous year. Spirulina supplements with more specific health focuses, such as immune health, energy support, and pain/inflammation, made up a small minority of overall sales (less than 1.5% each), and sales of these categories of spirulina products each declined by roughly 20% or more. Maintaining general health and wellness has long been among the top reasons for dietary supplement use in the United States, and consumers increasingly sought out supplements for "foundational" or preventive health benefits during the COVID-19 pandemic.^{28,29}

The resurgence of the "green drink" trend in recent years also likely impacted sales of spirulina supplements in 2022. Although fruit and vegetable juicing has been around for decades, green powders have increased in popularity since the beginning of the pandemic. Green powders, many of which contain spirulina and dehydrated green fruits or vegetables, are promoted as a no-effort nutrition boost when added to water or other beverages. (The spirulina sales figures in this report do not include most bottled green drinks, but SPINS does include sales of green powders that are labeled as dietary supplements.) Already suffering from pill fatigue, consumers in 2022 increasingly embraced "functional beverages" such as these as a convenient and colorful way to supplement their diets.^{30,31}

Green powders and drinks were perhaps most visible on social media platforms such as TikTok in 2022, and this trend continued in 2023. As of early December 2023, TikTok videos with the hashtag "greenpowder" had more than 55 million views and those with "greenjuice" had more than 560 million views.^{32,33} Videos featuring vibrant green drinks or murky green beverages (sometimes called "pond water") could delight or disgust viewers. These attention-grabbing videos often feature a list of supposed health benefits, from reduced bloating to clearer skin.³⁴ Other

Researchers have investigated the effects of spirulina supplementation on a wide range of conditions, including Alzheimer's disease, ADHD, COVID-19, HIV, male infertility, mental fatigue, and many others.

Spirulina

Arthrospira spp.

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spirulina-containing beverages that went viral in 2022 may have also boosted the ingredient's visibility, including the "Coconut Cloud Smoothie" (a \$17 blue drink originally sold at Erewhon Market, an upscale supermarket chain in Los Angeles³⁵) and an eye-catching blue beer produced by the French brewery Hoppy Urban Brew, which made international headlines.³⁶

A few standout brands of green powders also likely impacted 2022 sales of spirulina, most notably Athletic Greens. The company's flagship product is AG1®, a green powder supplement that contains 75 vitamins, minerals, and other ingredients, including spirulina. According to the company's website, AG1 supports "Foundational Nutrition."³⁷ Influencer promotions, celebrity endorsements, and other advertisements for Athletic Greens were widespread in 2022. As one *New York Times* headline put it: "You Can't Outrun Athletic Greens."³⁸

Among the 40 top-selling supplements in the 2022 mainstream channel, six other ingredients had sales increases greater than 20%: guarana (*Paullinia cupana*, Sapindaceae; +107%), maca (*Lepidium meyenii*, Brassicaceae; +64.9%), dandelion (*Taraxacum officinale*, Asteraceae; +62%), beet root (*Beta vulgaris*, Amaranthaceae; +52.4%), cinnamon (*Cinnamomum* spp., Lauraceae; +41.9%), and ashwagandha (*Withania somnifera*, Solanaceae; +20.1%).

Caffeine-containing Ingredients

Green Coffee Extract

Of the 40 top-selling ingredients, green coffee (*Coffea arabica*, Rubiaceae) extract experienced the largest percentage sales decrease in the 2022 mainstream channel. Sales totaled \$7,858,803 in 2022 — a 39.8% decline from the previous year. This corresponds to decreased annual sales of more than \$5 million in 2022, dropping it from the 33rd top-selling ingredient in 2021 to the 37th in 2022.

Mainstream sales of green coffee extract peaked in the mid-2010s. In 2015, it ranked 11th, with sales totaling

more than \$23 million. Since then, sales have declined steadily, apart from two years of increased sales in 2018 (+30.3%) and 2021 (+5%). From 2015 to 2022, annual sales of this ingredient decreased by more than \$15.5 million.

Green coffee extract is a caffeine-containing extract of raw, unroasted coffee beans. It gained popularity beginning in 2012, after it was promoted as a "magic weight loss cure" by Mehmet Oz, MD, on his daytime television talk show, "The Dr. Oz Show." A study he referenced when he discussed the ingredient on his show, in which participants reportedly lost an average of nearly 18 pounds by simply adding a green coffee extract supplement to their diet, was later retracted.³⁹ The reputation of green coffee extract was further tarnished after its potential benefits were questioned in widely publicized Senate hearings and consumer education campaigns on weight loss products.⁴⁰

Systematic reviews published in 2011 and 2023, both of which included only three studies each, found modest benefits of green coffee extract for body weight reduction, but the authors noted that the studies were largely of poor quality and had small sample sizes.^{41,42}

Consumer attitudes toward products marketed for weight loss have changed in the past decade. The "Dr. Oz effect," in which ingredients promoted on his show often saw significant sales increases, quickly diminished after the mid-2010s, and "The Dr. Oz Show" went off the air in January 2022. Shoppers, in general, have moved away from stimulant products for weight loss and instead have prioritized weight management for overall health. In 2022, sales of green coffee extracts marketed for weight loss, as a category, declined by 36.9%. Still, sales of these products made up roughly 85% of all green coffee extract supplements sold in 2022, corresponding to more than \$6.6 million in mainstream sales.

Guarana

Despite the nearly 40% decrease in 2022 mainstream sales of green coffee extract, another caffeine-containing herbal supplement ingredient, guarana, experienced a steep sales increase. Mainstream sales of guarana more than doubled from 2021 to 2022, with sales totaling \$20,798,795 in 2022 — a 107% increase. Increased sales of guarana, a medicinal plant from the Amazon, may be due to the plant's association with potential health benefits other than weight loss, namely energy support and sports performance. Mainstream sales of guarana products marketed for energy support totaled roughly \$10.1 million in 2022 — more than double the \$4.6 million in sales of guarana supplements sold for weight loss in 2022. Guarana products marketed for potential sports performance bene-

Coffee
Coffea arabica
Photo ©2024 Steven Foster Group



fits also outsold guarana products for weight loss by a wide margin and experienced the strongest overall growth of 9.7% in 2022.

Besides green coffee extract, four other ingredients in the mainstream channel experienced sales decreases greater than 20% in 2022: chamomile (*Matricaria chamomilla* syn. *M. recutita*, Asteraceae; -36.7%), cannabidiol (CBD; -29.3%), apple cider vinegar (ACV; -26.4%), and ginseng (*Panax* spp., Araliaceae; -23.6%).

NATURAL CHANNEL

Turmeric

Turmeric (*Curcuma longa*, Zingiberaceae) was the top-selling ingredient in the US natural channel from 2013 until 2018, when it dropped to the second position due to a surge of interest in CBD. In 2022, turmeric regained its top rank in the natural channel despite slightly decreased sales from 2021. Sales of turmeric in this channel have decreased slightly every year since 2018, when they peaked at more than \$51 million. Sales have decreased 30% overall from 2018 to 2022.⁴³

Turmeric’s popularity for more than a decade may stem from its being one of the more well-known Ayurvedic ingredients and its common use as a culinary ingredient. In fact, Google searches in 2022 point to increasing consumer awareness of turmeric as a functional food, with search terms including “fresh turmeric,” “turmeric ginger shots,” and “turmeric gummies.”⁴⁴

Turmeric is native to tropical South Asia, and its rhizome has been used in the traditional Indian medicine practices of Ayurveda and Unani for thousands of years.⁴⁵ In Ayurveda, turmeric is considered a treatment for respiratory conditions, arthritis, congestion, and more. In TCM, turmeric is considered a bitter digestive and carminative (flatulence reliever) and used to treat gastrointestinal and abdominal complaints. Curcumin, a yellow-orange polyphenolic pigment, has been studied for its antioxidant, anti-inflammatory, neuroprotective, and cardioprotective activities.⁴⁶ Curcumin is part of a group of compounds found in turmeric known as curcuminoids. While curcumin has high antioxidant activity and promising results against cancer cell lines, it has been found to have relatively low bioavailability in the human body. This raises challenges for manufacturers and questions for consumers who want to be sure that the products they purchase are effective.

Sales of turmeric decreased in multiple categories in 2022, including digestive and cardiovascular support and cold and flu, but increased in the cognitive health category. Curcumin has been studied in vitro and in vivo for its neuroprotective activities in conditions such as Parkinson’s disease, Alzheimer’s disease, age-related cognitive decline, and epilepsy.⁴⁷⁻⁴⁹ Human clinical trials on the effects of curcumin on cognition show mixed results. In a 2021 systematic review and meta-analysis of eight randomized, double-blind, placebo-controlled clinical

trials, no statistical differences in overall cognitive function were observed among groups, regardless of whether the participants were older healthy adults, diagnosed with Alzheimer’s disease, or diagnosed with schizophrenia.⁵⁰ However, working memory and processing speed improved significantly in the curcumin groups versus placebo.

Turmeric and curcumin also have been investigated for their effects in sports performance, providing a parallel with beet root, which had the largest sales growth of the 40 top-selling ingredients in the natural channel in 2022 and is known for its exercise and performance support. Clinical and animal studies indicate that curcumin supplementation may help prevent muscle atrophy in wasting diseases such as cancer, chronic obstructive pulmonary disease, and chronic kidney disease.⁵¹ Preparations of curcumin also have been associated with various benefits for exercise in healthy adults, including increased range of motion in joints, decreased muscle soreness, increased total antioxidant capacity, and decreased muscle injury versus placebo.⁵²

Notable Sales Increases: Beet Root and Algae

Beet Root

Beet root has had double-digit sales growth in the natural channel since 2020, but in 2021 and 2022, sales rose 41.3% and 42.8%, respectively.⁵³ One draw of beet root supplements is the plant’s high level of nitrates, which convert to nitric oxide (NO) in the body. In the human body, NO regulates blood vessel dilation, muscle contraction, and cellular energy production. Increased blood flow caused by



Turmeric
Curcuma longa
Photo ©2024 Steven Foster Group

NO supplementation can support cardiovascular health, exercise performance, and cognitive health.⁵⁴⁻⁵⁶ Though the body can naturally synthesize NO, this is enhanced through dietary supplementation of nitrates such as those found in beet root and leafy green vegetables. Beet root also contains betalains, antioxidant pigments that may contribute to the anti-inflammatory and lipid-lowering effects of beets.⁵⁷

According to SPINS data, in 2022, sales of beet root skyrocketed in the hair, skin, and nails category (+20,578.6%), immune health category (+1,472.3%), and cognitive health category (+276.8%), with a smaller increase in the energy support category (+2.1%). Beet root supplements with non-specific health focuses also saw significant sales increases (+27.9%) in 2022. Conversely, sales in the performance category were the only instance of a sales decrease (-69.8%) for beets in 2022.

Clinical trials on the use of nitrate supplementation to maintain cognitive health generally have mixed or negative results.⁵⁶ However, this is an emerging area of interest, and longer, more robustly designed studies are needed to further explore the potential benefits of beets for the brain. The benefits of beets for hair, skin, and nails are not well studied. These may be attributed to the increase of circulation to the scalp, anti-inflammatory properties that lessen signs of

aging, and presence of vitamins and minerals such as iron, magnesium, and potassium that help contribute to healthy hair, skin, and nails.

Studies on exercise performance continue to see improved outcomes in tasks that require power, speed, or acceleration, such as sprinting, high-intensity interval training, and weightlifting, by enhancing muscle contraction and blood flow.⁵⁵ In the area of cardiovascular health, beet root supplementation was associated with significant decreases in systolic (though no changes in diastolic) blood pressure in people with hypertension, one of the few areas in which beet root has been tested on a population other than healthy adults.⁵⁴

Algae

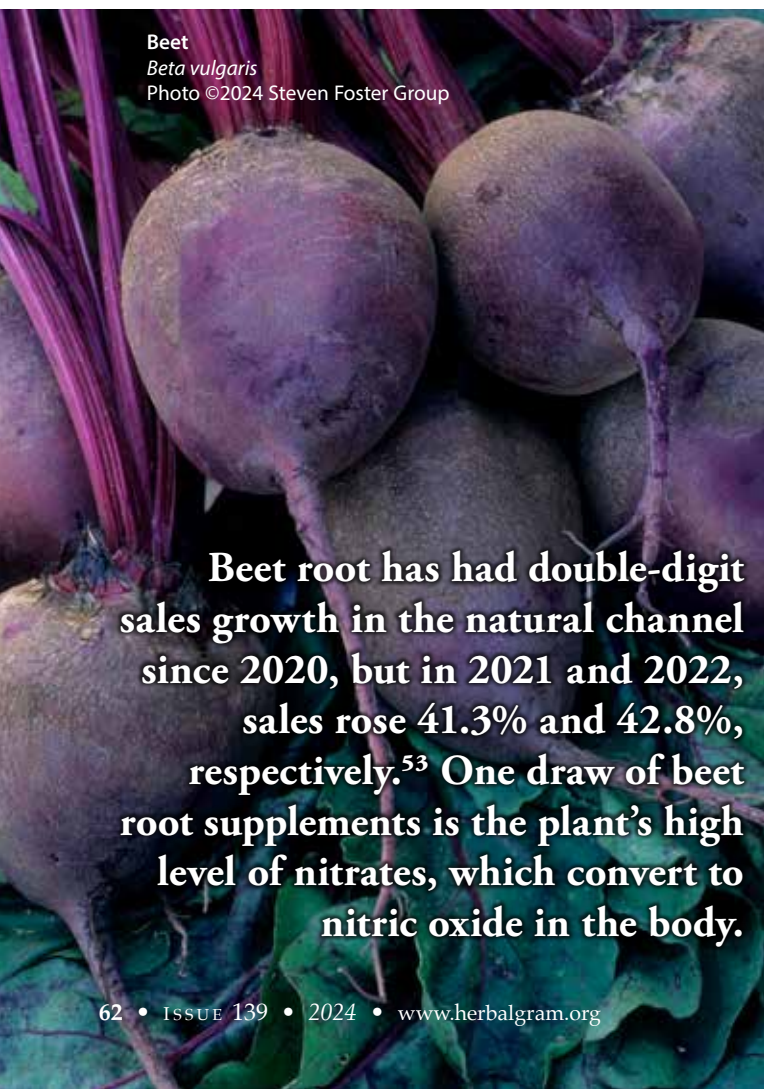
Algae supplements (a general category that excludes chlorophyll/chlorella and spirulina) entered the top 40 of the natural channel in 2021, possibly boosted by chlorophyll/chlorella's surge in popularity at the same time.⁵³ In 2022, sales of algae increased by 25.6% in the natural channel and totaled \$5,876,448.

"Algae" as a term can encompass anywhere from 30,000 to more than 1 million species ranging from single-celled organisms to fronds of seaweed. Types of algae include green algae (e.g., chlorella), red algae, and brown algae. Algae contain different pigmented carotenoids, vitamins and minerals that support bone health (e.g., vitamin D and calcium), and omega-3 fatty acids.^{58,59} Sales categories that saw increases for algae supplements in 2022 include cardiovascular health (+68.8%), cold and flu (+15.6%), joint health (+10.2%), and eye health (+5%).

Algae can support these health aspects in various ways. As an abundant source of anti-inflammatory omega-3 polyunsaturated fatty acids, carotenoids, sterols, and polysaccharides, algae can exert cholesterol-lowering effects in the body, reduce inflammation that causes arthritis, and reduce oxidative stress in the body that, over time, can result in chronic conditions, including cardiovascular disease and diabetes.⁵⁹

Each color of algae contains different carotenoid pigments, and each exerts different health effects. The most abundant carotenoids in green algae are beta-carotene, lutein, violaxanthin, and zeaxanthin.⁵⁸ Beta-carotene, as a precursor to vitamin A, and lutein and zeaxanthin, which are found in the macula of the human eye, exert protective effects on visual acuity and may slow the progression of age-related macular degeneration.⁶⁰ Red algae contain high amounts of zeaxanthin, lutein, and alpha-carotene. Red algae in the genus *Porphyra* (Bangiaceae) produce a sulfated carbohydrate known as porphyran, which has exhibited anticoagulant activity and antiviral activity that may support the immune system and lower blood lipid levels.⁶¹

Brown algae contain fucoxanthin, which has gained increased attention in the natural products industry for its antioxidant and glucose-stimulating activities. It also has been shown to reduce LDL and total cholesterol levels versus placebo in small clinical trials.⁵⁹ Fucoxanthin can stimulate the immune system, inhibit viral replication,



Beet
Beta vulgaris
Photo ©2024 Steven Foster Group

Beet root has had double-digit sales growth in the natural channel since 2020, but in 2021 and 2022, sales rose 41.3% and 42.8%, respectively.⁵³ One draw of beet root supplements is the plant's high level of nitrates, which convert to nitric oxide in the body.

and exhibit anti-tumor activity, though the mechanisms of action for this are not fully understood.⁶² For many of these uses, clinical trials are lacking, and most information for the activities of constituents of algae comes from in vitro and animal trials.

Notable Sales Decreases: Apple Cider Vinegar and Chlorophyll/Chlorella

Apple Cider Vinegar

Apple cider vinegar (ACV) entered the top 40 list in the natural channel in 2020 and sales increased by almost 100% from 2019.⁶³ In 2021, sales of ACV supplements more than doubled (+104.7%) compared to 2020.⁵³ Reasons for its appearance in the top 40 could include a push for healthier living during the outbreak of the pandemic, as ACV has a long history of use in traditional Western medicine; increased visibility of products through social media platforms like TikTok and the use of celebrity spokespeople, such as Jennifer Lopez, who appeared in television ads as the face of Goli® (West Hollywood, California) ACV gummies; and an initial surge in sales in the weight loss category.

In 2022, ACV sales decreased 45.1% from 2021 in the natural channel. However, in total sales, this is still a 22.9% increase from 2020, which indicates that ACV sales could be returning to pre-pandemic levels after its previous surge. New ACV products in 2022 include an ACV-based energy supplement from Bragg® Live Food Products (Santa Barbara, California), a company known for selling ACV as a culinary item.⁶⁴ Bragg True Energy Apple Cider Vinegar supplements are capsules that contain B vitamins and 750 milligrams of acetic acid derived from ACV per serving.

Before the launch of its supplement in early 2022, Bragg filed a complaint against Goli with the National Advertising Division (NAD), a division of the Better Business Bureau.⁶⁵ The NAD recommended that Goli discontinue or modify its advertising after concluding that the amount of ACV in a suggested daily dose of the company’s gummies was not an active dose, to “avoid conveying the unsupported message that the amount of ACV contained in its gummies is associated with the health benefits of traditional liquid ACV.”⁶⁶ However, later in 2022, after Goli appealed, the NAD rescinded its original recommendation and concluded that Goli had provided sufficient substantiation to use “Apple Cider Vinegar” in its product name.⁶⁷

Sales of ACV declined in the energy support category, along with immune health and cleanse and detox, which were driving categories in previous years. Despite this, and the sales decrease, ACV remained one of the top health trends on TikTok in 2022.⁶⁸

Chlorophyll/Chlorella

As sales of algae supplements increased in 2022, sales of chlorophyll/chlorella in the natural channel declined by 20.2%. Sales in 2022 were still higher than in 2019, though sales numbers may be returning to pre-pandemic levels.⁶⁹ Similar to spirulina, as discussed previously, chlorophyll/

chlorella initially benefited from social media attention, particularly with influencers on TikTok and Instagram, who tout “chlorophyll water” (a chlorophyll tincture added to a glass of water) for detoxification and energy support.

Some human trials have been conducted on *Chlorella* (Chlorallaceae), a genus of green algae. No significant effects were observed for glycemic control, lipid profiles, and anthropometric indices in people with type 2 diabetes mellitus after chlorella supplementation.⁷⁰ However, modest results were seen in post-exercise fatigue in healthy adults,⁷¹ reducing the amount of carcinogenic heterocyclic amines in urine,⁷² and changes in total cholesterol and serum lipids in participants with mildly high cholesterol.⁷³ All these studies were of short duration and had small sample sizes, and additional studies are needed to substantiate whether chlorophyll or chlorella supplementation has health benefits in these areas.

DIRECT SALES

In 2022, direct sales of herbal dietary supplements decreased for the first time since 2008. Direct sales of these products totaled \$6.788 billion in 2022, a 5.1% decrease



Apple cider vinegar
Malus spp.
Photo ©2024 Steven Foster Group

Table 6. Total US Retail Sales of Herbal Supplements by Type (Single vs. Combo)

	Total Sales	% Total Sales	% Change
2022			
Single Herbs	\$6.227 billion	51.4%	-2.3%
Combination Herbs	\$5.894 billion	48.6%	-1.3%
2021			
Single Herbs	\$6.376 billion	51.6%	5.9%
Combination Herbs	\$5.974 billion	48.4%	14.0%
2020			
Single Herbs	\$6.022 billion	53.5%	11.5%
Combination Herbs	\$5.238 billion	46.5%	24.7%
2019			
Single Herbs	\$5.402 billion	56.3%	6.3%
Combination Herbs	\$4.201 billion	43.7%	11.8%
2018			
Single Herbs	\$5.083 billion	57.5%	6.8%
Combination Herbs	\$3.759 billion	42.5%	13.1%
2017			
Single Herbs	\$4.759 billion	58.9%	5.6%
Combination Herbs	\$3.326 billion	41.1%	12.9%
2016			
Single Herbs	\$4.505 billion	60.5%	6.1%
Combination Herbs	\$2.947 billion	39.5%	10.1%
2015			
Single Herbs	\$4.245 billion	61.3%	5.5%
Combination Herbs	\$2.677 billion	38.7%	10.7%
Source: <i>Nutrition Business Journal</i>			

from the previous year (Table 3). This decline follows five years of double-digit growth in this category. From 2017 to 2019, sales growth hovered around 11% each year, and the strongest direct sales growth occurred during the pandemic, when sales rose by 23.7% in 2020 and 15.8% in 2021. Despite the decreased sales in 2022, direct sales that year were still roughly \$609 million greater than in 2020.

thirds of overall sales, but the sales gap has been narrowing since then, as marketers offer more combination products.

As noted in previous *HerbalGram* market reports, combination formulas contain multiple herbs that may work together (either additively and/or synergistically) to support a general health function or related health functions. For

Direct sales of herbal supplements in 2022 were greater than sales in the mass market channel and the natural, health food, and specialty channel (both separately and combined). Direct sales have accounted for a majority of overall sales since at least 2005.

NBJ's direct sales channel includes online sales from major retailers (e.g., Amazon, Walmart, etc.), as well as sales from direct media (TV, radio, and print), health practitioners, and multi-level marketing companies.⁶⁹

SINGLE VS. COMBINATION HERBS

Before 2022, annual sales growth of combination products had been higher than that of single-herb products since 2011, with sales of combination products growing by more than 10% each year since 2012. In 2022, sales of single-herb supplements and combination herbal products both decreased — by 2.3% and 1.3%, respectively.

Sales of single-herb supplements totaled \$6.227 billion in 2022, accounting for 51.4% of sales. Combination herb sales totaled \$5.894 billion, or 48.6% of sales. Purchases of single-herb products once made up a significantly greater percentage of overall sales. In 2010, for example, sales of single-herb products accounted for roughly two-

The normalization of sales in 2022 was evident across multiple categories of herbal supplements. Products that experienced unprecedented sales growth at the beginning of the pandemic generally continued to decline, including sales of some immune ingredients such elder berry, which decreased by more than 10% in both mainstream and natural retail channels.

example, a combination supplement marketed for stress relief may contain herbs with adaptogenic properties and other ingredients typically used for mood support.⁷⁴ Single-herb supplements tend to have more specific uses, sometimes more than one. Ginkgo (*Ginkgo biloba*, Ginkgoaceae) leaf extract, for example, is used commonly for its potential cognitive and memory benefits and to support cardiovascular health.⁷⁵

CONCLUSION

In the first three years of the COVID-19 pandemic, total US sales of herbal supplements experienced both the highest sales growth and the only sales decline in almost two decades. Reduced sales in 2022 reflect an expected return to more typical consumer spending on herbal supplements as the pandemic waned. The decrease in sales follows two years of record-breaking sales increases in 2020 and 2021, during which total annual US sales grew by more than \$1 billion each year. Total annual sales of herbal supplements in 2022, even after declining from the previous year, were still more than \$2.5 billion greater than pre-pandemic spending in 2019.

The normalization of sales in 2022 was evident across multiple categories of herbal supplements. Products that experienced unprecedented sales growth at the beginning of the pandemic generally continued to decline, including sales of some immune ingredients such as elder berry, which decreased by more than 10% in both mainstream and natural retail channels. Herbal supplements that went viral on social media platforms such as TikTok in 2021, including apple cider vinegar and chlorophyll/chlorella supplements, also experienced sales decreases in 2022.

Social media continued to drive growth of specific herbal supplements in 2022, including products promoted for digestive health such as psyllium, and ingredients such as spirulina that were used to make attention-grabbing functional beverages. Adaptogens and traditional Ayurvedic ingredients that have been on the rise in recent years, such as ashwagandha and turmeric in the mainstream channel, continued to experience sales increases in 2022, as did mushrooms in the natural channel. Finally, herbal ingredients marketed for energy support and/or sports performance, including guarana and beet root, also saw significant sales increases, and this trend is expected to continue. 📈

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Rice fields
Oryza sativa
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Ginkgo

Ginkgo biloba

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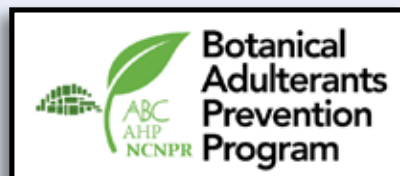
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 British Herbal Medicine Association (UK)
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Council for Responsible Nutrition (US)
 Global Curcumin Association (GCA)
 International Alliance of Dietary/Food Supplement Associations (IADSA)
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 Natural Astaxanthin Association (NAXA)
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Nonprofit/Professional Associations

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 American Association of Naturopathic Physicians
 American Herbalists Guild
 American Society of Pharmacognosy
 AOAC International
 Council of Colleges of Acupuncture and Oriental Medicine
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 Irish Register of Herbalists (IRE)
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Seeing through the Smoke: A Cannabis Specialist Untangles the Truth About Marijuana by Peter Grinspoon. Amherst, NY: Prometheus Books; 2023. Hardcover, 442 pages. ISBN: 978-1-63388-846-3. \$29.95.

By Mark J. Plotkin, PhD

Cannabis (*Cannabis sativa*, Cannabaceae) may be the most loved and feared plant of all time. From the “reefer madness” of the 1930s in the United States to The Beatles singing “everybody smokes pot” in “I Am the Walrus” just three decades later, few angiosperms have been so condemned and adored.

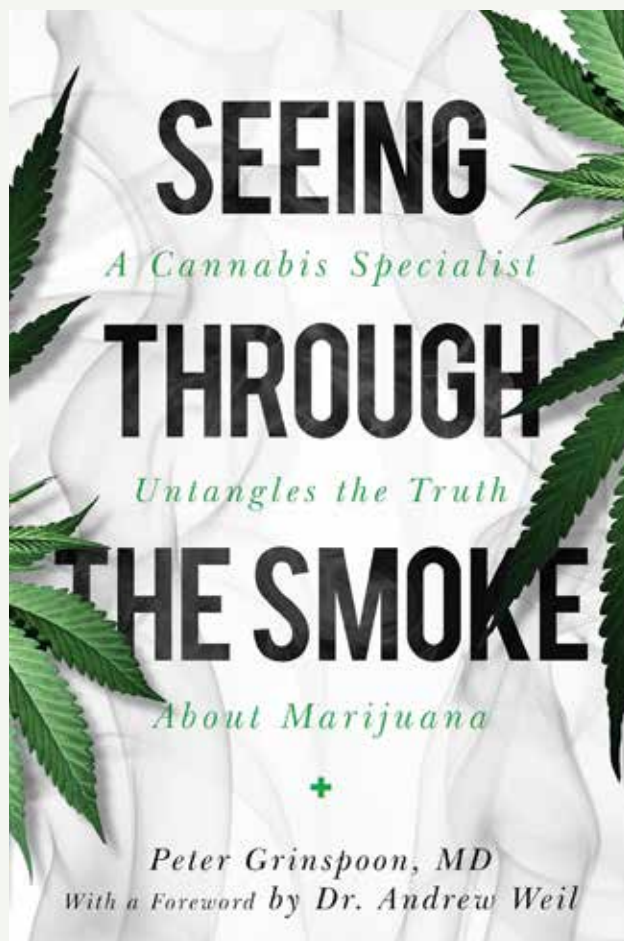
Some cannabis enthusiasts may not realize that the earliest known use of this plant was as a source of fiber. Evidence from several locations in China indicates that humans were making rope from hemp more than 5,000 years ago. Cannabis remains one of the most versatile plants ever discovered. It is not only a source of high-quality fiber (in fact, a corruption of the name became the word “canvas”), but a high-quality oil (both edible and used for industrial purposes), an edible “fruit” (in botanical terms, an achene), a medicine, and a narcotic (i.e., in the sense of the term “sleep-inducing,” rather than the sense of being a drug of dependence).

By 1000 BCE, cannabis was being used both as a medicine and a mind-altering substance in China and India. Early Chinese sources refer to it as both “a giver of delights” and “a liberator of sin” — perhaps a precursor of what we know as “reefer madness.”

Herodotus (ca. 484–ca. 425 BCE), a Greek historian and the so-called “Father of History,” wrote that Scythian horsemen of the Eurasian steppe would enter tents filled with cannabis smoke, causing them to “delight, and dance with joy!” Recent archaeological finds in that region have lent credibility to his account. And Galen (129–ca. 216 CE), the most famous physician in the Roman Empire, noted that Roman feasts sometimes featured intoxicating cannabis cakes, meaning that pot parties and the equivalent of magic brownies were being enjoyed more than a thousand years before the 1960s (though the Roman cake would lack chocolate, which is derived from *Theobroma cacao* [Malvaceae], a plant introduced to Europe much later).

But it was in the 1960s that cannabis came to the fore in American culture. What once had been enjoyed primarily by jazz musicians and immigrant workers took college campuses by storm. And that storm continues to increase in power and reach. Today, cannabis is one of the most valuable crops grown and consumed in the United States. The shift toward decriminalization and legalization for both recreational and medical use reflects changing attitudes and increased appreciation for both the economic and medical benefits of this extraordinary plant. Ironically, cannabis use has become so widespread that aging baby boomers who once rushed back to their dorm rooms to fill their bongos are now complaining about the widespread cannabis clouds that pervade urban landscapes from Times Square to Berkeley.

The popularity of cannabis has spurred the publication of a seemingly unending stream of articles and books on the subject. It can be difficult to separate the wheat from the chaff



— or, in this case, the seeds from the buds. Understanding, appreciating, and benefiting from the therapeutic aspects of cannabis can be particularly challenging, given the overabundance of information and misinformation on the topic.

Filling this void is a wonderful new book by physician Peter Grinspoon, MD, of Harvard Medical School. Unlike virtually every other leading spokesperson in the field of cannabis science, Peter can say that his role is partly hereditary: He is the son of the late Harvard psychiatrist Lester Grinspoon, MD (1928–2020). As cannabis was becoming increasingly popular on college campuses in the late '60s, the elder Grinspoon began studying the literature to “define scientifically the nature and degree” of the potential dangers of cannabis, but he soon realized it was not only much less harmful than advertised but actually beneficial and sometimes therapeutic. His book *Marihuana Reconsidered* (Harvard University Press, 1971) was an influential work on the safety and efficacy of cannabis, and he became a much beloved figure on the Harvard campus when both he and renowned Harvard ethnobotanist Richard Schultes, PhD (1915–2001), would testify on behalf of people being prosecuted for possession of minuscule amounts of pot.

This culminated in the elder Grinspoon’s testifying on behalf of John Lennon when the Nixon administration was trying to deport the ex-Beatle on the basis of a previous hashish possession charge from years earlier. Grinspoon’s

testimony helped free Lennon while earning Nixon's undying enmity. (Grinspoon's rapier wit on the witness stand was legendary. When an aggressive prosecutor asked how he could be an expert on cannabis if he had never tried it, the professor snapped back: "I'm an expert on schizophrenia, and I've never tried that, either!")

All this is to say that Peter Grinspoon has been an observer and participant in the cannabis conversation since he was a small child. Woven through the book are personal reminiscences that make it more compelling: He first smelled cannabis smoke at age seven when his elder brother, Danny, who was dying of acute lymphocytic leukemia, was given cannabis to mitigate the nausea and vomiting induced by chemotherapy. His once-alcoholic uncle, who was trapped in an abusive marriage, was able to transition from vodka to cannabis and move on to a happier relationship and a more fulfilling life. Grinspoon shares in the book that yet another brilliant relative was able to better manage his ADHD symptoms thanks to cannabis and went on to study and teach artificial intelligence at a prestigious university. It is this combination of the author's personal experience, insight, and humor that makes this book come alive.

Seeing through the Smoke is divided into four sections: "How Did We Get Here" (a compelling and preceptive history of cannabis use), "How Harmful? A Measured Approach," "What's the Buzz? Benefits and Potential," and "Enhancement," which focuses on cannabis and wellness. It also includes a foreword by integrative physician and author Andrew Weil, MD.

The backbone of the book is Grinspoon's answering some of the most common questions and uncertainties regarding cannabis use: Is it addictive? Does it cause psychosis? How does it function in the body? Does it affect pregnancy or breastfeeding? Can teenagers smoke it without adverse effects?

Grinspoon is clear that cannabis is not a panacea. In the book, he writes: "I understand how this drug affects different people, at different doses, in different circumstances." He writes about the potentially harmful effects of cannabis consumption, in addition to the many therapeutic benefits.

Equally valuable are his thoughts, insights, and recommendations regarding cannabis use for some of the greatest medical challenges of our time: insomnia, inflammation, cancer, opioid addiction, and other afflictions.

Grinspoon's book is destined to be considered a classic, and it belongs on the bookshelves of anyone who has ever tried (or even thought of trying) this extraordinary plant. If I had to provide a list of the folks who would benefit from reading and learning from this work, it would include physicians, patients, parents, and politicians, from the "marijuana-curious" to confirmed stoners. *Seeing through the Smoke* encompasses history, policy, chemistry, biology, and healing, and has my highest recommendation. **H**

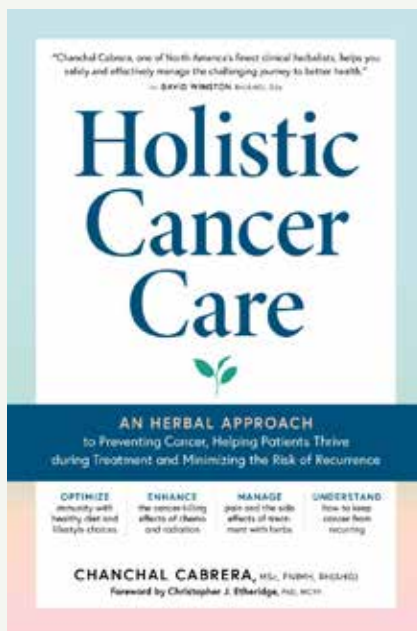
Mark J. Plotkin, PhD, is president of the Amazon Conservation Team (www.amazonteam.org) and host of the popular podcast "Plants of the Gods."

Holistic Cancer Care: An Herbal Approach to Preventing Cancer, Helping Patients Thrive during Treatment and Minimizing the Risk of Recurrence by Chanchal Cabrera. New York, NY: Storey Publishing; 2023. Softcover; 576 pages. ISBN: 9781635863734. \$29.99.

By Leanna Standish, PhD, ND, LAc, FABNO

I was not prepared to like this book. Before I opened it to the table of contents, I thought, "Do we really need another wishful thinking book on integrative cancer care?" As soon as I began reading, however, I realized that Chanchal Cabrera's book is a unique and necessary compendium of advanced herbal knowledge that is directly pertinent to cancer patient care. The book is useful for both people with cancer and health care providers.

Cabrera, FNIMH, RH (AHG), is a medical herbalist, has been in clinical practice for 35 years, and specializes in holi-



tic oncology. She is also the author of *Fibromyalgia: A Journey Toward Healing* (McGraw-Hill Education, 2002) and previously held the faculty chair in botanical medicine at the Boucher Naturopathic Medical Clinic in New Westminster, British Columbia.

The 10 chapters of Cabrera's new book cover the use of herbal therapies to help prevent cancer and prepare for and recover from cancer surgery, how to use botanical medicines for pain management, and how to enhance the positive effects and mitigate the adverse side effects of chemotherapy and radiotherapy. Part 1 contains six chapters and is appropriate for both patients and providers. Chapter 1, "Understanding Cancer," is based on the current, rarely contested consensus that "it all starts with a gene mutation." The chapter thankfully also includes some discussion of viral and bacterial infections

as being causal in some types of cancer. The inclusion of specific herbal tea formulas is especially valuable. For example, Cabrera includes a decoction and infusion formula to

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BOOK REVIEWS

help ease patients' and their families' grief, sadness, and despair. This book provides practical and feasible actions and herbal formulas to make for patients and their caregivers.

The second half of the book, Part 2, is directed toward integrative oncology health care providers. The author provides an extensive herbal *materia medica*, which is complete with oral and topical herbal formulas and well-written, well-grounded explanations of scientific developments related to checkpoint inhibitors, tumor genetics, cancer growth factors, metabolism, and other aspects of cancer medicine.

Chapter 9, "Materia Medica for Managing Cancer: The Cytotoxic Herbs," is especially valuable. Cabrera describes safe and effective ways to use herbs with powerful cytotoxic and immunomodulatory properties to reduce tumor mass, including species of *Artemisia* (Asteraceae), *Camptotheca* (Nyssaceae), *Phytolacca* (Phytolaccaceae), *Podophyllum* (Berberidaceae), *Sanguinaria* (Papaveraceae), *Taxus* (Taxaceae), *Thuja* (Cupressaceae), and *Viscum* (Santalaceae). She also provides specific formulas and dosing strategies. The book provides sufficiently detailed information about these plants so that practitioners will feel more confident in prescribing them safely. Through case histories of breast, bladder, and lung cancer, Cabrera shows how to use nutrients and herbal therapies in the right patients at the right time. In this way, her book is a new and needed treasure for integrative oncologists.

While the text does not point to published scientific references to support each of Cabrera's statements, the bibliography associated with each chapter is excellent. Her formulas are clearly based on decades of clinical experience, which gives her book the gravitas required to guide both patients and health care providers on the use of herbal therapies. The index is complete and helpful in finding information on specific herbs, conditions, and formulas. I anticipate that the widespread application of Cabrera's approach and formulas will improve both clinical and quality of life outcomes in people with cancer.

The Advanced Integrative Medical Science (AIMS) Institute's Cancer Outcomes Study is set up to capture the impact of holistic care of people with cancer. Because of Cabrera's botanical medicine formulas that we naturopathic oncologists at AIMS Institute will be implementing, we expect improved quality of life, as well as improved disease and overall survival, all of which can be and are measured.

I have assigned Cabrera's book as required reading to my oncology medical residents. This book was assembled by a true herbal medicine expert and is an excellent addition to the field of integrative oncology. **H**

Leanna Standish, PhD, ND, LAc, FABNO, is the co-founder and co-director of the Advanced Integrative Medical Science (AIMS) Institute, senior research scientist at Bastyr University's School of Naturopathic Medicine, and a fellow of the American Board of Naturopathic Oncology.

Raphael Mechoulam

1930–2023

By Connor Yearsley

Raphael Mechoulam, PhD, a Bulgarian-born Israeli chemist and professor and the “Father of Cannabis Research,” died at his home in Jerusalem on March 9, 2023, at age 92. His work helped lay the foundation for modern scientific research on cannabis (*Cannabis sativa*, Cannabaceae).^{1,2}

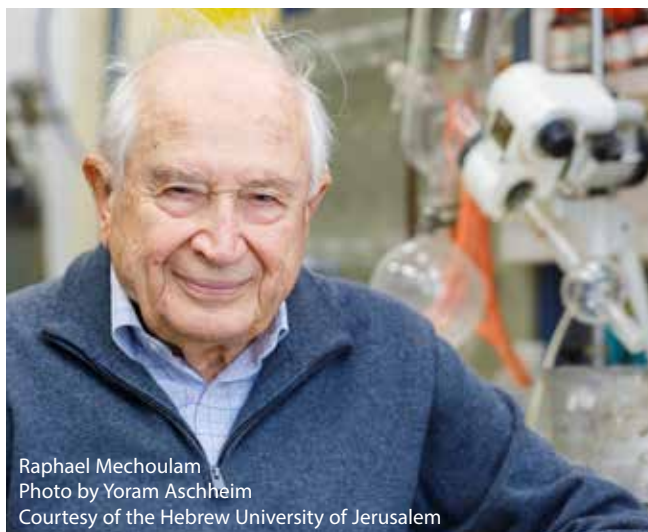
His many achievements include the isolation and structure elucidation of tetrahydrocannabinol (THC, cannabis’ main psychoactive compound) and cannabidiol (CBD, an important non-intoxicating compound from cannabis), as well as the discovery of the first endocannabinoids (cannabinoids that the human body produces naturally and that help regulate normal and critical physiological functions).¹⁻³ He authored or co-authored more than 500 scientific papers, which have been cited more than 75,000 times, according to Google Scholar.

Mechoulam was born on November 5, 1930, in Sofia, Bulgaria, into a Jewish family, the son of Moreno and Rosa Mechoulam. His father, a prominent physician who had studied in Vienna at one of the most prestigious medical schools in Europe, was the head of a hospital in Sofia, while his mother had been educated in Berlin. His family’s interests included books, concerts, theater, and medicine. For several years, he attended an American grade school in Sofia, where he had “the only regular schooling” he could remember. Then, World War II started, and the pro-German Bulgarian government closed the school. Antisemitic laws made life “almost unbearable” for his family.^{4,5}

His parents believed they would be safer in small villages in the Balkans, where physicians were needed. They spent most of the war in these impoverished villages. Mechoulam made daily trips to the village pumps to bring home pails of water, and he read the few available books by candlelight. Despite being the only physician in the area, his father was sent to a concentration camp in 1944, but he survived. The family emigrated to newly created Israel in 1949.^{4,5}

In 1952, Mechoulam graduated with a master’s degree in biochemistry from the Hebrew University of Jerusalem.³ In 1953, he was conscripted into the Army and, as part of an Army research unit, worked mainly on insecticides.^{4,5} He also met his wife, Dalia, during their army service. “Surprisingly, I first tasted the sweet taste of research in the Army,” Mechoulam was quoted as saying.⁴ “I found the independence of research to be an addiction from which I do not want to be cured.”

Mechoulam received his PhD in chemistry under the supervision of Professor Franz Sondheimer (1926–1981) at the Weizmann Institute of Science in Rehovot, Israel, in 1958, with a thesis that focused on synthetic chemistry, mainly steroids. He did his postdoctoral studies (1959–1960), which investigated the structures of plant triterpenes, with Professor William Pelletier (1924–2004) at The Rockefeller Institute (now The Rockefeller University) in New York.



Raphael Mechoulam
Photo by Yoram Aschheim
Courtesy of the Hebrew University of Jerusalem

From 1960 to 1965, he held a position at the Weizmann Institute of Science, where he began researching cannabis. He then moved to the Hebrew University of Jerusalem, where he continued his research for the next 55 years. He became a full professor at the Hebrew University of Jerusalem in 1972 and the Lionel Jacobson Professor of Medicinal Chemistry in 1975. Between 1979 and 1982, he was the university’s rector.^{1,3-5}

Mechoulam’s interest in natural products led him to read the literature on cannabis’ chemistry and pharmacology. He knew several languages, including Spanish, French, German, and Russian, in which most of the earlier scientific literature on cannabis was written.⁴ “I was surprised to note that an active compound had apparently never been isolated [from cannabis] in pure form,” Mechoulam wrote in a retrospective in the *Annual Review of Pharmacology and Toxicology*.⁵

He also noted that German pharmacist Friedrich Sertürner (1783–1841) isolated morphine from opium (from the opium poppy [*Papaver somniferum*, Papaveraceae]) in the early 1800s, and British chemist Sir Robert Robinson (1886–1975) determined morphine’s complicated chemical structure in the 1920s. German chemist Albert Niemann (1834–1861) isolated cocaine (from coca [*Erythroxylum coca*, Erythroxylaceae] leaves) in the mid-1800s, and German chemist Richard Willstätter (1872–1942) described its unusual structure in the late 1800s or early 1900s. Yet, by the mid-1900s, “the chemistry of cannabis was not known. So, it looked like an interesting project,” Mechoulam said in a CNN interview in 2014.⁶

Cannabis research likely was neglected for various reasons before that. Cannabinoids, a term Mechoulam coined later, are present in cannabis as a mixture of many closely related compounds that were apparently difficult to separate using the laboratory methods available in the 1800s and early 1900s. Scientists often avoid research on mixtures because the results are difficult to reproduce and interpret.⁴ Cannabinoids, including THC and CBD, are highly lipophilic (fat-loving), which also made them difficult to isolate at that time. Previous pharmaceuticals derived from plants were primarily water-soluble alkaloids, such as morphine

and cocaine, which were much easier to manage. THC is also very “sticky” and adheres to glassware. And, because cannabis was an illicit substance in many places, it was not available to many scientists.

To obtain cannabis for his research, Mechoulam first went to the administrator of the Weizmann Institute of Science, who called a police officer he knew and said that Mechoulam was completely reliable and needed hashish, a concentrated cannabis preparation. Mechoulam went to the police and obtained five kilograms of confiscated hashish.^{4,5} On the bus back to Rehovot, people commented on the “strange smell.”⁶ Later, he learned that he and the police had broken the law. “Luckily, being ‘reliable,’ I just had to apologize,” he was quoted as saying.⁴

After that, Mechoulam obtained hashish from the police for more than 40 years, with documents signed by the Ministry of Health. “I still wonder whether the absence of bureaucracy in my dealings with the regulatory bodies has something to do with the fact that most of the pharmacists working at the Ministry are my ex-students, and they believe that their ex-professor is ‘reliable,’” he was quoted as saying.⁴ “Working in a small country certainly has its positive aspects.”

In 1963, Mechoulam’s first publication on cannabinoids described the structure of CBD. He first re-isolated CBD, which both American chemist Roger Adams (1889–1971) and British biochemist Lord Alexander Todd (1907–1997) previously had isolated, but whose structure was only partly known. Mechoulam and his friend, Yuval Shvo, determined CBD’s structure mainly with nuclear magnetic resonance (NMR) analysis.^{4,5}

In 1964, Mechoulam and another friend at the Weizmann Institute of Science, Yehiel (or Yechiel) Gaoni, PhD (1928–2017), reported the isolation and structure of THC. They worked with Haviv (or Habib) Edery, the head of pharmacology at a nearby laboratory, who had a group of rhesus monkeys. Biological work using the monkeys allowed them to perform an activity-guided fractionation and eventually led to isolation of the active component. Chromatographic separations of an extract produced a pure, oily compound, and its structure was determined with NMR and elemental analysis. They named the compound THC.⁴

Mechoulam was highly interested in the potential benefits of cannabinoids. For example, he and colleagues in Brazil conducted a 1980 double-blind clinical study that investigated the effects of CBD in people who had uncontrolled epilepsy. Some participants treated with CBD had almost no convulsive events, and others were helped significantly.^{4,5,7} “As new antiepileptic drugs were badly needed, we assumed that these results would be expanded by pharmaceutical companies, but nothing happened for over 30 years,” Mechoulam wrote.⁵ “Thousands of patients could have been helped over the four decades since our original publication.”

In 1988, neuropharmacologist Allyn Howlett, PhD, and colleagues identified a cannabinoid receptor in rat brains, the CB1 receptor, which is part of the endocannabinoid system (ECS, a biochemical signaling system that is involved with normal physiological functions and mediates cannabis’

effects in the body). Mechoulam assumed that this receptor does not exist for the sake of plant cannabinoids but indicates the presence of an endogenous (internally produced) brain ligand (a molecule that binds to a receptor to produce a cellular signal). He wanted to identify this compound, which would eventually be called anandamide, the first endocannabinoid to be discovered.^{4,5}

Mechoulam assumed that pig brains would be the most promising source of the ligand because of biochemical similarity between pigs and humans. William Anthony Devane, PhD (d. 2018), who had worked in Howlett’s lab and was then a postdoc in Mechoulam’s lab, and Lumír Ondřej Hanuš, PhD, a Czech analytical chemist, tried to solve the isolation problems associated with the ligand. Because of the lipophilic nature of cannabinoids, they assumed the brain ligand would also be a lipid and worked on that basis.^{4,5}

“The isolation problems were at first almost insurmountable,” Mechoulam was quoted as saying.⁴ “As soon as fractions which bound to the cannabinoid receptor were purified, they started to lose their activity. We know now that this was due to the lack of stability of the cannabinoid ligand.”

For Mechoulam, the breakthrough came when NMR analysis led to the realization that the ligand was a polyunsaturated fatty acid derivative. More mass spectra and NMR evaluations determined the structure of the compound. They sent some impure material to Roger Pertwee, DPhil, in Scotland, and he determined the compound produced activity similar to THC.⁴

They named it anandamide. Devane was learning Sanskrit at the time and suggested “ananda” (from Sanskrit for “joy”), while “amide” refers to part of its chemical structure. “We believed then—and still do—that the endocannabinoid system plays a role in the formation of emotions,” Mechoulam was quoted as saying.⁴ “I looked for a suitable Hebrew equivalent but nothing came to mind. There are many synonyms for ‘sorrow’ in Hebrew but considerably [fewer] for ‘joy.’ In any case, anandamide certainly brought joy to us.”

Lumír Hanuš wrote (email, April 30, 2023):

I worked with Raphi for 28 years and have more than 40 publications with him.... In February 1990, he invited me to Israel for one year. He also invited a specialist in molecular pharmacology and [co-discoverer] of CB1 receptors, William Devane.... In his laboratory, I was supposed to isolate, from the brain, a compound that binds to the cannabinoid receptors. So, I isolated and Bill tested my isolates for binding activity to the CB1 receptor.... On March 24, 1992, I finally isolated this ligand, and we named it anandamide.

I was with Raphi for almost three decades. Only Aviva Breuer and I were in his laboratory for such a long time. Raphi liked graduate students and liked helping them and trying to get them to be first authors on his publications. That was generous of him. When it was a holiday, he always invited all the lab staff to his house to celebrate. Until July 2021, he drove to the laboratory in his car.... Under his guidance, I achieved the

highest possible position at the Hebrew University of Jerusalem. He was one of the biggest foundation stones in this field for his many years of exceptional research.

In 1993, Sean Munro, PhD, and colleagues identified another cannabinoid receptor, the CB2 receptor, this one in the spleen. Mechoulam asked his PhD student, Shimon Ben-Shabat, PhD, to try to find the ligand that activates this receptor. In 1995, they reported the isolation and structure of the ligand, 2-arachidonoylglycerol (2-AG). They later found that fatty acid esters that accompany 2-AG strongly enhance its activity, and this “entourage effect,” a term they coined to describe the way cannabinoids work together synergistically, may be common with cannabinoid ligands.⁴

“The endocannabinoid system is a latecomer to our knowledge in chemistry, pharmacology, and physiology,” Mechoulam wrote.⁵ “Its involvement in biological processes is enormously wide, but most of the endogenous anandamide-like compounds and 2-AG-like compounds have yet to be investigated for their activity.”

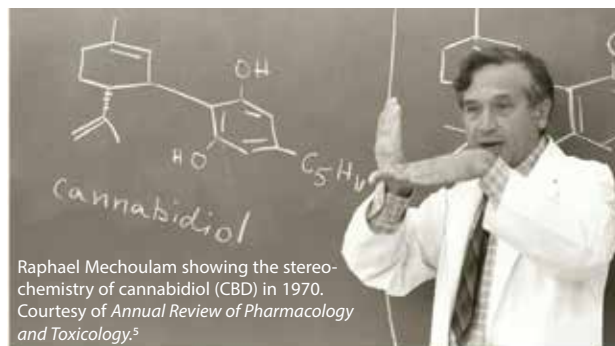
Ethan Russo, MD, a neurologist, highly respected medical cannabis expert, former senior medical advisor for GW Pharmaceuticals (a company known for developing cannabis-derived prescription medicines including Sativex® and Epidiolex®), and member of the American Botanical Council’s (ABC’s) Advisory Board, wrote (email, March 17, 2023):

Raphi was my mentor and friend for 24 years, as we attended meetings and worked together and separately over that time in 14 countries. His contributions to the fields of cannabis and the endocannabinoid system were astoundingly broad and deep, encompassing the isolation and synthesis of THC, CBD, cannabigerol, cannabichromene, and the acid cannabinoids, as well as discovery of the first and most important endocannabinoids, arachidonoyl ethanolamide (“anandamide”) and 2-arachidonoylglycerol (2-AG), and many other semisynthetic analogues employed in basic research, some of which may yet reach the clinic.

He never was satisfied to “stay in his lane” as a chemist, but rather was always seeking therapeutic possibilities for his discoveries, including the earliest trials of CBD for epilepsy and graft vs. host disease, THC for nausea and vomiting in children, dexamibinol for treatment of head trauma, endocannabinoids for osteoporosis, and many others. Beyond all that, Raphi was a Renaissance man, learned and wise in many fields, and kind and generous to all. He will be missed.

Rick Doblin, PhD, the founder and executive director of the Multidisciplinary Association for Psychedelic Studies (MAPS), wrote (email, April 7, 2023):

In March 2015, Raphael Mechoulam, the world’s leading pioneer in cannabinoid research, came to a small dinner I organized in Jerusalem with Stan-



Raphael Mechoulam showing the stereochemistry of cannabidiol (CBD) in 1970. Courtesy of *Annual Review of Pharmacology and Toxicology*.⁵

islav Grof, MD, the world’s leading pioneer in LSD research, who I had brought to Israel for a series of lectures and meetings. Listening to these two giants in their fields speak to each other with such appreciation and respect was incredibly inspiring. They each had no peers and were delighted with the opportunity to get to know each other.

In person, Raphi was humble and kind. He made enormous contributions to the field of cannabis research and cannabis policy reform. What made me so sad was that many people were making a great deal of money from the legal medical and adult-use cannabis markets, in large part due to Raphi’s work, but he frequently lacked sufficient funding for his research lab.

Pal Pacher, MD, PhD, FAPS, FAHA, FACC, the senior investigator of the Laboratory of Cardiovascular Physiology and Tissue Injury of the US National Institutes of Health’s (NIH’s) National Institute on Alcohol Abuse and Alcoholism (NIAAA), wrote (email, June 12, 2023):

Our connection ... led to collaborations on diverse subjects, such as the role of cannabinoid 2 receptors (CB2R), endocannabinoids, endocannabinoid-like ligands in tissue function/injury, the development of improved CB2R agonists, and the potential therapeutic applications of CBD in cardiovascular and liver diseases.


Raphi’s visionary discoveries, including elucidating the chemical structures of the biologically active constituents of cannabis and the identification of endocannabinoids, have significantly contributed to the foundation of the cannabinoid research field. Over his distinguished career, he made numerous other groundbreaking findings. His brilliance as a scientist, generosity as a collaborator, and mentorship to countless trainees have left an indelible mark on the field.

Raphi exemplified kindness and warmth. He was a devoted father, grandfather, husband, and friend. With the passing of this giant in the field of pharmacology, we mourn the loss of an exceptional individual who touched the lives of many.

During his distinguished career, Mechoulam received many awards, including the Israel Prize for chemistry

(2000), the international Heinrich Wieland Prize (2004), the European College of Neuropsychopharmacology (ECNP) Lifetime Achievement Award (2006), the Israel Chemical Society Prize for Outstanding Scientist (2008), the US National Institute on Drug Abuse (NIDA) Discovery Award (2011), the Rothschild Prize in Chemistry (2012), the EMET Prize in Exact Sciences (2012), ABC's Norman R. Farnsworth Excellence in Botanical Research Award (2017), and Technion's Harvey Prize (2019–2020).^{1,3}

In 1994, Mechoulam was elected a member of the Israel Academy of Sciences and Humanities. He was a founding member of the International Alliance for Cannabinoid Medicines (IACM) and the International Cannabinoid Research Society (ICRS).¹ The ICRS named its highest award the Raphael Mechoulam Award, which has been given annually since 2000. He also edited at least four books, wrote many book chapters, received honorary degrees from various universities, and was awarded at least 25 patents for his discoveries. He is the subject of Zach Klein's 2015 documentary "The Scientist."⁸

Raphael Mechoulam is survived by his wife, Dalia (Borowitz) Mechoulam; son, Roy Meshulam; daughters, Dafna Golan and Hadas Mechoulam; and grandchildren.² 

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Ara Harold DerMarderosian 1935–2023

By John A. Beutler, PhD

Pharmacognosist Ara DerMarderosian, PhD, died on September 11, 2023, in Smithfield, Rhode Island, at age 88. Ara was born on January 6, 1935, the son of Karnig and Anahid (Goolkasian) DerMarderosian, and grew up in Somerville, Massachusetts. He graduated from Somerville High School in 1952 and attended the Massachusetts College of Pharmacy in Boston, graduating with a BS in 1956 and an MS in pharmaceutical chemistry in 1958.

He received his PhD in pharmaceutical chemistry at the University of Rhode Island in 1964 under the tutelage of respected pharmacognosy professor Heber W. Youngken, Jr., PhD. His doctoral thesis involved the ergot alkaloids of several species in the Convolvulaceae (morning glory) family.

In 1964, he joined the faculty at Philadelphia College of Pharmacy and Science (PCPS), the nation's oldest school of pharmacy, founded in 1821 (now merged with Saint Joseph's University), where he rose through the ranks to become professor of pharmacognosy in the Department of Biology and research professor of medicinal chemistry in the Department of Chemistry. He taught at PCPS for 56 years until his retirement in 2020. He was also the scientific direc-



Ara DerMarderosian

tor of the school's Complementary and Alternative Medicines Institute.

From 1965 to 1995, he lectured on pharmacology at the Pennsylvania College of Podiatric Medicine (now Temple University School of Podiatric Medicine) and was an adjunct associate professor of pharmacology at the University of Pennsylvania School of Veterinary Medicine. In addition, he was the science advisor to the US Food and Drug Administration (FDA) Phila-

delphia Regional Laboratory for a decade and a consultant for the regional Poison Control Center in Philadelphia.

His diverse research interests included hallucinogenic botanicals, the phytochemistry and pharmacology of medicinal and poisonous plants, marine pharmaceuticals, drugs of misuse, and nutraceuticals. He continued his work with morning glory alkaloids from *Argyreia nervosa* (Convolvulaceae), and several plants of this species were memorable occupants of the rooftop greenhouse at PCPS. The greenhouse also housed several small peyote (*Lophophora williamsii*, Cactaceae) cacti.

Ara testified in court as an expert witness in a number of drug cases, most memorably when the Pennsylvania State Police seized more than a kilogram of cocaine and brought it to the lab for analytical investigation. This did not lead to a scientific publication, but, not long after, to a television appearance on a local Philadelphia station.

Memories of Ara

Ara was a guiding light in my career and my life. My path started with degrees in zoology and marine biology, where I studied toxic marine dinoflagellates. This led to a recommendation from my advisor at Long Island University to go to PCPS and study marine pharmacognosy with Ara. His influences shaped my approach to science and life. An aficionado of the pun and the shaggy dog story, he was always smiling and optimistic, qualities that influenced my own approach to work and life.

He took great pains to make sure that his mentees were exposed to the breadth and depth of pharmacognosy. Although my research focus was marine antimicrobials, Ara was constantly providing us with small side projects that allowed us to use all of our pharmacognosy skills, from microscopy through analytical chemistry. We analyzed seized cannabis for [the presence of] the herbicide paraquat and identified suspected poisonous mushrooms. In the 1970s, we performed authentication of commercial ginseng products in conjunction with Mark Blumenthal, the Herb Trade Association, and the Ginseng Research Institute, and even got on television with a local consumer advocate who was outraged by ... nicotine-containing plastic cigarettes that looked like children's toys.

All this led to a seize-the-day approach to opportunities, and, in the end, it was the ginseng work that landed me my postdoc appointment at FDA, my job at the American Herbal Products Association, and then my National Institutes of Health (NIH) career at the Office of Dietary Supplements.

I will miss Ara greatly. He was a world-class artist, musician, scientist, and friend.

—**Joseph Betz, PhD**, vice president of the American Society of Pharmacognosy, member of the American Botanical Council's Board of Trustees, and former acting director of the Office of Dietary Supplements at the US National Institutes of Health

In addition to Ara's exceptional depth and breadth of expertise on so many topics, he demonstrated fine family values and personal qualities. He encouraged both his students and his colleagues and urged socialization and sharing of experiences among faculty members.... Ara also had the boldness to speak up and even challenge academic administrators about matters on which he had concerns.

Ara began his professional career at a time when the areas of pharmacognosy and natural products were considered very important. He observed and experienced a decline in interest in these areas, with the result that pharmacognosy was changed from a required to an elective course in pharmacy curricula and eventually to a point when the course was not even available as an elective. However, Ara's enthusiasm and advocacy for these areas never wavered, and I am so pleased that he subsequently experienced the resurgence of interest and recognition of the importance of these areas. He became the "go-to" person for his fellow faculty and the media for questions regarding natural products, dietary supplements, foods as medicine, nutrition, etc., not just because of his own personal expertise, but also because no one else came close to knowing what he did.

He had an intellectual curiosity about so many different topics and avidly reviewed many publications and news sources. Even in "retirement," he would distribute information from articles he found interesting to many of us who might not have been aware of them.

—**Daniel Hussar**, dean emeritus and Remington Professor at Philadelphia College of Pharmacy at St. Joseph's University

One of the most rewarding aspects of being involved in the medicinal plant research community is the friendships I have made with scores of intelligent, interesting, talented, and unique people. These adjectives begin to, but do not fully, describe Ara DerMarderosian. He was clearly one of my favorite people in the pantheon of older pharmacognosists who kindly gave me their time and helped mentor me in the fascinating world of the history and science of medicinal plants.

My relationship with Ara spanned about 45 years. Ever since I first met him in the late 1970s at an Herb Trade Association herb symposium in Santa Cruz, California, he became a friend and mentor. Ara, along with the late Norm Farnsworth, Varro "Tip" Tyler, Jim Duke, John Staba, and other [experts in] pharmacognosy and ethnobotany, was one of the first sources of scientific information on whom I relied for many articles in the 1980s and up until the past five years or so. His knowledge of the history of pharmacy was extensive, and he was always very generous with his time in peer-reviewing articles for *HerbalGram*.

In addition to being a scientist, he was a talented, humorous, and fun person. I will always cherish my calls to him on his birthday every January so we could share information, jokes, and puns — often bad puns, but he had no reservations about them. To Ara, an important part of life was about fun. It's as if he was an embodiment of the true meaning of *fundamental*: fun should always come before *da mental*!

—**Mark Blumenthal**, founder and executive director of the American Botanical Council and editor-in-chief of *HerbalGram*

Dr. Ara DerMarderosian was a longtime active member of the American Society of Pharmacognosy (ASP) and one of the few members who actively researched hallucinogens and poisons, in addition to his expertise in the alkaloids from morning glory varieties and many other research interests. He regularly attended ASP meetings throughout his career. The ASP extends its sympathy to his wife Evelyn, son Ronald, and their families.

—**Tawnya McKee, PhD**, president of the American Society of Pharmacognosy

Ara was a mentor to me. My doctoral research at the University of the Sciences [formerly PCPS] in 2010 focused on African ethnobotanicals used for improving health. I went on to be an NIH T32 postdoc working on botanicals to treat metabolic syndrome, a Fulbright Scholar and NIH Fogarty K01 grant awardee in Kenya, and later secured a California Department of Food and Agriculture (CDFA) grant to promote *Moringa* [Moringaceae] in California. Ara played a vital role in my career. Ara's passion for plants and people carries on through my work and many of the other students he mentored and influenced. Ara was absolutely incredible!

—**Carrie Waterman, PhD**, assistant researcher in the Department of Nutrition at UC Davis

Ara was a good friend. We had a group of faculty who routinely would gather for lunch in the cafeteria at 11:30 to beat the student crowd at noon. Lunch usually had a joke/story telling competition. Ara usually won. I was always impressed with Ara's many talents — artist, magician, musician, and storyteller. He once created a comic figure out of an orange peel while peeling the orange. A particularly fond memory was our participation in the Faculty Follies!

—**Roger L. Schnaare, PhD**, professor emeritus in the Department of Pharmacy Practice at Saint Joseph's University

A highlight of the pharmacognosy lab course was when samples from the PCPS opium collection from the 19th century were displayed. Ara's interest in history led him to curate the college's collection of pharmaceutical antiques, many of which were donated from the estate of pharmacist Eli Lilly. A further example of his historical interests was arranging a *National Geographic* magazine photo shoot in which a legendary Sumerian cuneiform tablet loaned from the Penn Museum was surrounded by herbs mentioned in the tablet from 2100 BCE.

His students explored the quality of commercial Asian ginseng (*Panax ginseng*, Araliaceae) samples, as well as the phytochemistry of a miniature wild species, *Panax trifolius*, growing in the woodlands of Pennsylvania. A collaboration with renowned Harvard ethnobotanist Richard E. Schultes, PhD, led to an investigation of *Banisteriopsis* (Malpighiaceae) chemistry. The effects of the alkaloid securinine from the Far Eastern Russian/Chinese plant *Flueggea suffruticosa* (Phyllanthaceae) were studied in people with amyotrophic lateral sclerosis (ALS). The toxic *Amanita* (Amanitaceae) mushrooms also received attention. Marine invertebrates were sourced from Florida and lyophilized (freeze-dried), and then the extracts were studied for antimicrobial activity. He graduated 11 doctoral students and 12 master's students.

He authored or co-authored approximately 100 scientific publications, including books and magazine articles in pharmacy

publications. He was the senior editor of *The Review of Natural Products*, which was published by Facts and Comparisons and eventually extended to eight published editions. The eighth edition, comprising 2,052 pages and more than 400 monographs from acacia gum to zinc, is also available in an electronic format.

Ara was truly a Renaissance man. His avocations included Armenian music, fine art painting, calligraphy, ivory scrimshaw, and jewelry making, as well as bicycling, gourmet cooking, pharmaceutical and botanical philately (stamp collecting and study), and collecting books, tools, and antiques. He played the clarinet and oud (a Middle Eastern lute-type stringed instrument) with the Boston Orientales and the Hellenic String Band and also performed traditional Armenian music at folk music events.

Ara DerMarderosian is survived by his wife Evelyn (Messerialian), to whom he had been married for 62 years; his son, Ronald DerMarderosian and his wife, Maral; son-in-law John Torcomian; three grandchildren; and two brothers. He was predeceased by his daughter Laura Torcomian and brother Aaron DerMarderosian. 📖

John Beutler, PhD, works at the Molecular Targets Program at the US National Cancer Institute in Frederick, Maryland. He received his PhD in pharmacognosy at PCPS under the mentorship of Professor DerMarderosian in 1980 and edited *The Review of Natural Products* with DerMarderosian.

William Blaine 'Bill' Richardson III 1947–2023

By Hannah Bauman

Former Congressman and Governor of New Mexico Bill Richardson died at his summer home in Chatham, Massachusetts, on Cape Cod, on September 1, 2023, at age 75. Though probably best known for his international negotiations on behalf of some 80 families of Americans who were wrongfully detained or held hostage abroad,¹ Richardson was the first Democrat in the US House of Representatives to support the Dietary Supplement Health and Education Act of 1994 (DSHEA). This landmark legislation established dietary supplements as a subset of foods, in a separate category from drugs, and created a new framework for enforcement from the US Food and Drug Administration (FDA).

Richardson was born in Pasadena, California, on November 15, 1947. He was raised in Mexico City by his father, William Blaine Richardson Jr., an American banking executive, and his mother, María Luisa López-Collada Márquez, a Mexican secretary. At age 13, Richardson returned to the United States to attend a boarding school in Concord, Massachusetts, for the rest of his primary schooling.

After earning a bachelor's degree in French and political science from Tufts University in the greater Boston area in 1970 and a master's degree in international affairs from Tufts in



Bill Richardson

1971, Richardson began his political career as a staffer for Congressman F. Bradford Morse (R-MA) from 1971 to 1973 and worked for the State Department under Henry Kissinger (1923–2023) in 1974. He then served as a staff member for the Senate Committee on Foreign Relations until 1978, when he moved to New Mexico, where, due to his Hispanic heritage and the state's large Hispanic population, he believed he had the best chance of being elected to public office.

Richardson's first campaign to represent New Mexico's first congressional district ended in a loss to the Republican incumbent Manuel Lujan in 1980. However, in 1982, New Mexico created a third congressional district, and Richardson was elected to the position, which he held from 1983 until 1997.

During his time in Congress, Richardson sponsored many bills involving Native American rights and served as chairman of the Congressional Hispanic Caucus and Democratic chief deputy majority whip (in the US House of Representatives, the whip of the majority party is the third-highest ranked member of the party, outranked by the majority leader and the Speaker of the House, and holds influence over other party members). His foreign relations work included working closely with President Bill Clinton to help pass the North American Free Trade Agreement (NAFTA) in 1993, negotiating with Iraqi President Saddam Hussein for the release of two detained Americans in 1995, and meeting with Slobodan Milošević, former president of Serbia and Yugoslavia, in 1996.

Though Richardson is not closely associated with DSHEA, unlike the bill's main sponsors in the US Senate, Senators Orrin Hatch (R-UT, 1934–2022) and Tom Harkin (D-IA), his leadership in the House of Representatives was key to the bipartisan support that led to the bill's passage. Richardson used his knack

for negotiation to convince two of the bill's most powerful opponents, Representatives Henry Waxman (D-CA) and John Dingell (D-MI, 1926–2019), of the value and necessity of the legislation.

In an email notice released by the United Natural Products Alliance (UNPA), a natural products industry trade association, on September 5, 2023, after Richardson's death, UNPA Senior Political Advisors Patricia Knight and Peter Reinecke wrote about Richardson's key support of DSHEA:

It was [Richardson's] foundational support along with that of Democratic Senator Tom Harkin whose bipartisan efforts led to passage of DSHEA without any opposition at all — an amazing accomplishment. He helped lay the groundwork for many years of strong bipartisan support in Congress for dietary supplement issues. [H]is passing ... is a great moment to remember how important it is for [members of the dietary supplement industry] to build allies in Congress who understand our issues and can fight to advance our work to provide consumers with dietary supplements that can do so much to improve their healthy lifestyles.

After the passage of DSHEA in 1994, Richardson negotiated the release of Evan Hunziker from North Korea and secured a pardon for Eliadah McCord, an American who was convicted and imprisoned in Bangladesh, in 1996. His work releasing American prisoners from abroad eventually resulted in several Nobel Peace Prize nominations, though he never received it.

Richardson left Congress in 1997 and served as the US ambassador to the United Nations from 1997 to 1998. In 1998, he became the Secretary of Energy under Clinton. In this position, he notably helped implement the first plan in the United States to dispose of nuclear waste, created a Director for Native American Affairs position for the department, and oversaw the return of 84,000 acres to the Northern Ute Tribe of Utah, the largest transfer of federal lands to a Native American tribe in more than a century.

From 2003 to 2011, Richardson served two terms as governor of New Mexico. During his tenure, he negotiated the release of Pulitzer Prize-winning journalist Paul Salopek, who was imprisoned in Sudan while on a *National Geographic* assignment, in 2006; approved the legalization of medical cannabis (*Cannabis sativa*, Cannabaceae) in 2007 and said it was “the right thing to do” regardless of possible political ramifications²; attempted to run for president in 2008 but dropped out of the race after the first primary and endorsed Barack

Obama; and repealed the death penalty in the state in 2009. He was under consideration for a position as Commerce Secretary for the Obama Administration but withdrew his candidacy after a federal grand jury investigation into allegations of corruption during his time as governor. Ultimately, the grand jury declined to seek indictments.

Richardson was also an adjunct professor at the John F. Kennedy School of Government at Harvard University, lecturer at the United World College of the American West in Montezuma, New Mexico, and taught courses at the University of New Mexico and New Mexico State University. He was the senior managing director of what was then Kissinger McLarty Associates, an advisory firm that was headed by Henry Kissinger and former Clinton White House Chief of Staff Mack McLarty, and served on the boards of multiple corporations and organizations, including Peregrine Systems, Valero Energy, Diamond Offshore Drilling, and the National Institute for Civil Discourse at the University of Arizona. He also founded his own organization, the Richardson Center, to further his work in releasing prisoners and hostages globally. Richardson was involved in negotiations to secure the release of student Otto Warmbier from North Korea (unsuccessfully) in 2016 and political prisoner Paul Whelan from Russia (unsuccessfully) in 2022, and successfully negotiated the release of basketball player Brittney Griner in 2022.

Richardson authored or co-authored three books: his autobiography *Between Worlds: The Making of an American Life* with Michael Ruby (G.P. Putnam's Sons, 2005), *Leading by Example: How We Can Inspire an Energy and Security Revolution* (John Wiley & Sons, 2008), and *How to Sweet-talk a Shark: Strategies and Stories from a Master Negotiator* with Kevin Bleyer (Rodale Books, 2013). For his diplomatic work with then-Mexican President Carlos Salinas de Gortari during the passage of NAFTA, he earned the Mexican Order of the Aztec Eagle, Mexico's highest honor given to a non-citizen for services to the Mexican nation.

Bill Richardson is survived by Barbara Richardson (née Flavin), his wife of 51 years. **HE**

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FOOD AS MEDICINE

RASPBERRY

Rubus idaeus, Rosaceae

Both the fruit and the leaf of the raspberry plant have been staples in folk medicine across many cultures, including Aboriginal Australian, Native American, and ancient Chinese and European, for hundreds of years. While the leaf commonly is used during labor and pregnancy, its astringent properties have also made it a popular remedy for diarrhea, wound healing, and other conditions. Modern research has focused on the benefits of the fruit's polyphenol content, as well as further investigating traditional uses of the leaf.

Fast Facts

- The species name *idaeus* refers to Mount Ida in Greece, where myth states that raspberries originated. The Greek name for raspberry, *batos idaia*, likewise translates to “Idaian bramble” in reference to myth.
- In medieval Europe, raspberry fruits symbolized wealth and fertility in art.
- Native American tribes used many parts of the raspberry plant medicinally, including the roots, canes, and flowers.
- According to a survey of certified nurse-midwives in the United States, raspberry leaf is among the most popular herbal ingredients used to stimulate labor.

Phytochemical Focus

- Raspberry leaves contain high amounts of hydrolyzable tannins, particularly ellagitannins, which provide their astringent flavor and effects.
- Raspberry fruit is high in anthocyanins, which give the fruit their bright red color. These antioxidant compounds have strong anti-inflammatory effects.
- The digestion of raspberry fruit polyphenols has been shown to promote diversity in gut microflora, increase beneficial metabolites in the blood stream, and increase production of short-chain fatty acids.
- Raspberry seed oil is high in polyunsaturated fatty acids, vitamin E, phenolic compounds, and tocopherols, and is a popular ingredient in cosmetics for its antioxidant properties, fatty acid components, and vitamin E content. The antioxidant effects of the seed oil also may provide protection from the ultraviolet rays of the sun.

Raspberry
Rubus idaeus
Photo ©2024 Steven Foster Group

Nutrition Profile		
Per 100 g of raspberry fruit		
Excellent source of		
Vitamin C	28.3 mg	31.4% DV*
Dietary Fiber	8 g	28.6% DV
Manganese	0.61 mg	26.4% DV
Good source of		
Biotin	4.22 mcg	14.1% DV
Copper	0.07 mcg	7.2% DV
Magnesium	23.6 mg	5.6% DV

* DV = Daily Value as established by the US Food and Drug Administration, based on a 2,000-calorie diet.

About ABC's Food as Medicine Series

The Food as Medicine article series published in the American Botanical Council's (ABC's) monthly e-newsletter HerbalEgram highlights a conventional food and explores its history, traditional uses, nutritional profile, and modern medicinal research. The articles also feature an easy recipe to encourage readers to experience the extensive benefits of these whole foods.

The full “Food as Medicine: Raspberry” article with references is available on ABC's website in the HerbalEgram section (September 2023 issue).

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