Botanically-based ingredients have received attention due to their validated efficacy and key roles in many cosmeceutical formulations on the market today. In addition to their primary functions, many provide ancillary benefits that promote protection from environmental offenders, especially UV rays. Some also act as phytokines, protecting the skin from signs of aging and acting as inflammatory mediators. Understanding the individual mechanisms of action of the more commonly used botanicals will solidify the necessity of botanicals in cosmeceutical skin care products.

### Polyphenols

Polyphenols are antioxidants found in a wide range of botanical sources that provide an even wider range of benefits to the skin. Many of these plant-derived polyphenolic antioxidants offer anti-inflammatory photoprotection from UV radiation and anticarcinogenic properties, while others act as immunomodulators. Polyphenols can be derived from multiple botanical sources, including fruits, tea extracts, or plants. The polyphenols used most often in topical formulations include soy isoflavones, epigallocatechin gallate (EGCG), grape seed extracts, resveratrol, and ferulic acid.

The relevant compounds derived from soy are the isoflavones, or phytoestrogens. These polyphenolic plant compounds have a direct effect on the skin by binding to estrogen receptors. When applied topically, soy isoflavones can mimic the human hormone estrogen, which plays a key role in increasing skin thickness by way of improving collagen production and increasing microcirculation, thus improving the blood supply to the skin. This reduction in dermal matrix degradation minimizes apparent sagging and wrinkling, making soy isoflavones multifunctional botanical ingredients.

Non-denatured soybean extracts can also be used to reduce hyperpigmentation and delay hair growth, and even show compelling evidence in photoprotection. Genistein, an isoflavone found in soybeans, inhibits tyrosine protein kinase (TPK), which can have a carcinogenic effect in the skin. Topical application of non-denatured soybean extract has shown the capacity to reduce UV-induced skin edema and erythema while also protecting cells from UVB-induced damage. Ultimately, this multi-functional botanical can provide a safe and efficacious means of carcinogenesis prevention.

### Melanogenesis Inhibitors

- Licorice root extract (glabridin)
- Azelaic acid
- Kojic acid

### Chemopreventives

- Caffeine
- Silymarin

### Botanicals With Cutaneous Benefits

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Chronic inflammation plays a significant role in skin aging, thus many anti-aging products contain anti-inflammatory ingredients. Over-exposure to UV rays tends to be the most universal culprit of increased inflammation in the skin. Soy
extracts have been found to inhibit cyclooxygenase-2 (COX-2), an enzyme responsible for the formation of biological mediators that cause an inflammatory response.4,6

In recent years there has been an undeniable increase in the consumption and topical use of green tea as a means of preventing disease in Western culture. Of the multiple polyphenols found in the Camellia sinensis plant, epigallocatechin gallate, or EGCG, is the most plentiful.1 Known most often as a source of antioxidant protection when applied topically, EGCG has also been studied in depth for its chemopreventative benefits. Copious clinical studies have revealed a clear correction of and protection against numerous UV-induced cellular alterations when EGCG is applied prior to or immediately following UV exposure. EGCG has the ability to reverse the immunosuppressive effects of UV rays,7 quenching hydrogen peroxide radicals8 and inducing degradation of carcinogenic cutaneous cells.9

Grape seed extract, found in the botanical Vitis Vinifera, has been used in abundance for topical application due to its myriad ancillary benefits, including free radical scavenging, anti-oxidant, anti-mutagenic, anti-inflammatory, anti-cancer, and antimicrobial properties.10 Research also suggests that grape seed extract may have a hand in preventing melasma—in one study, upon completion of a six-month clinical trial involving orally administered grape seed extract, there was a proven decrease in the melanin-index in 83 percent of participants.10

Resveratrol is a well-known polyphenolic compound found in grapes, berries, peanuts, and cocoa.12-14 The free radical scavenging capabilities of resveratrol, both when applied topically or when ingested, are undeniable. In recent years, resveratrol has become the subject of intensive study and has been proven to be an extremely potent inflammatory mediator and a modulator of genetic expression via signal transduction.15 Phyto-hormonal effects of resveratrol show compelling evidence that suggests a decrease in pre-menopausal symptoms, which can halt selective cytoplasmic and membrane surface estrogen receptor agonists to slow skin aging, as reported by Verdier-Sevrain, et al.16

Ferulic acid is a polyphenol antioxidant found in many botanical sources, including rice bran and tomatoes. Although not as potent as green tea polyphenols, ferulic acid is still beneficial in protecting and repairing the skin from free radical damage.17,18 Often used in conjunction with L-ascorbic acid and vitamin E due to its synergistic interactions, ferulic acid assists in improving the stability and efficacy of the latter, respectively, while also doubling the photoprotection of the skin.19

MELANOGENESIS INHIBITORS

Hyperpigmentation is the deposition of melanin (pigment) due to the stimulation of melanogenesis, the process by which pigment is produced and duplicated in the skin. It is the end result of the immune system triggering an inflammatory response, which then triggers melanocyte activity to protect the skin’s DNA from damage and mutation. This process is instigated by any hormonal trigger or cutaneous inflammation, resulting from exposure to heat, trauma, and sun. The process of melanogenesis is complex and often misunderstood and requires multiple pigment inhibiting ingredients to best suppress the reaction at multiple points. Some of the more effective botanical ingredients known to provide exceptional melanogenesis inhibition include licorice root extract, azelaic acid, and kojic acid.

Glubridin, the main ingredient in licorice root extract, provides both melanogenesis inhibition and anti-inflammatory benefits to the skin. Research indicates that glubridin inhibits tyrosinase activity, specifically the activities of T1 and T3 tyrosinase isozymes.20 In vitro studies showed the anti-inflammatory effects of glubridin by its inhibition of superoxide anion production and cyclooxygenase activities.21 Since cutaneous inflammation is a direct trigger of the melanogenesis process, the multifunctioning capabilities of licorice lend tremendous benefit to those suffering with unwanted pigmentation.

Naturally derived from wheat, rye, and barley, azelaic acid was used initially for the topical treatment of acne vulgaris. It was later discovered that its inhibitory effects on tyrosinase would also play a role in diminishing melasma and post-inflammatory hyperpigmentation.22 In vitro studies have shown a significant interference with DNA synthesis and mitochondrial enzymes in abnormal melanocytes, while leaving normally functioning melanocytes unharmed.21 When combined with taurine, an antioxidant, one study concluded an even more powerful effect on tyrosinase activity.21 This shows that optimal results when addressing pigment deposition come from multiple melanogenesis inhibitors used in conjunction.

Kojic acid is naturally found in wheat, pears, bearberries, blueberries, and cranberries. It chelates copper bound to tyrosinase and decreases the number of melanosomes and dendrites.22 Its success as a melanogenesis inhibitor is enhanced when used in combination with other skin lightening ingredients, such as emblica, from the Indian gooseberry, hydroquinone, or glycolic acid.22

CHEMOPREVENTATIVE BOTANICALS

The term “chemoprevention” refers to efforts to prevent or delay the development of cancerous lesions or tumor growth by the ingestion of medication, specific fruits and vegetables, supplements, or other sources. There are two highly researched botanical ingredients used in cosmeceuticals for their ability to force UVB-induced sunburn cells into apoptosis to avoid tumorigenesis: caffeine and silymarin.

The scientifically proven inhibition of tumorigenesis and the resultant development of skin cancer is currently the
“Sometimes tried and true botanical ingredients provide the best outcome for a variety of skin conditions. They serve an undeniable role in many cosmeceutical formulations.”

MULTIFUNCTIONAL BENEFITS OF BOTANICALS

As science advances in the field of skin health, myriad new topical options emerge. Sometimes tried and true botanical ingredients provide the best outcome for a variety of skin conditions. They serve an undeniable role in many cosmeceutical formulations, providing benefits ranging from antioxidant protection to melanogenesis inhibition, and even chemoprevention. Their multifunctional capabilities make them ideal choices to achieve and maintain the overall health and appearance of the skin.

Jennifer Linder, MD is a dermatologist and Mohs micrographic skin surgeon, serving as Chief Scientific Officer for skin care and chemical peel company PCA SKIN, and running a private practice out of Scottsdale, AZ. She holds a clinical faculty position in the Department of Dermatology at the University of California San Francisco. Dr. Linder is a spokesperson for The Skin Cancer Foundation and sits on the Editorial Board of the Cosmetics Journal. She has been frequently interviewed by the press and published in trade publications, journals and textbooks, most recently “A Practical Guide to Chemical Peels, Microdermabrasion & Topical Products” by Rebecca Small, Dalano Hoang and Jennifer Linder; and the chapter “Cosmeceutical Treatment of the Aging Face” in “Aesthetic Medicine: Art and Techniques,” edited by Peter M. Predergast and Melvin A. Shiffman.