Antioxidant. The word itself is magic. Suggesting some type of all-encompassing protection against cellular wear and damage, the scientific-medical community has now embraced a once reviled theory. Using the antioxidant concept as a spearhead in proposed mechanisms for staving off so-called "free-radical" reactions, the rush is on to mine claims for the latest and most effective combination of free-radical scavenging compounds.

Without disputing or supporting the concept that aggressive oxygen species are the new culprit for most illnesses (superseding the microbial causative drama of the 19th century), we must acknowledge that such "radicals" have definitively been shown to damage all biochemical components such as DNA/ RNA; carbohydrates; unsaturated lipids; proteins; and micronutrients such as Carotenoids (alpha and beta carotene, lycopene), vitamins A, B6, B12, and folate.

Defense strategies against such aggressive radical species include enzymes, antioxidants that occur naturally in the body (glutathione, uric acid, ubiquinol-10, and others) and radical scavenging nutrients, such as vitamins A, C, and E, and Carotenoids.

This paper will present a brief discussion of some well- and little-known phytopharmaceuticals (i.e., herbs) that may add to the optimization of antioxidant status and therefore offer added preventive values for overall health. It is important to state at the outset that antioxidants vary widely in their free-radical quenching effects and each may be individually attracted to specific cell sites. Further evidence of the specialized nature of the Carotenoids is demonstrated by the appearance of two Carotenoids in the macula region of the retina where beta-carotene is totally absent (Handelman, 1988). These two retina specific Carotenoids are zeaxanthin (a yellow pigment found in corn seeds, sweet red pepper, bitter orange peel, and in green algae) and lutein (found in the green leaves of all higher plants, also in algae, in citrus rind, in apricot, peach, plum, apple, and cranberry).

How the Antioxidants Complement Rather Than Compete with One Another

As scientific inquiry proceeds we will likely learn of other site-specific attractions and functions of the Carotenoids. This will help us understand why we need not reject one class of antioxidant compounds to accept another. They each may accumulate in specialized cells and tissues, with some overlapping protection, but a variety of them is required to give us the best protection possible.

Interestingly, just as foods work together so do the antioxidants. Professor Lester Packer of the University of California at Berkeley is one of the world's pre-eminent antioxidant researchers. He and coworkers recently demonstrated how Carotenoids interact with vitamins E and C. Beta-carotene, it was shown, can protect LDL against oxidative damage even when vitamin E levels are low (Packer, 1993).

In this regard, antioxidants act synergistically, offering a rainbow of protection rather than a single band of the spectrum. Moreover, plant antioxidants such as phenols and bioflavonoids may potentiate vitamin antioxidants. For example, rutin, a bioflavonoid, potentiates vitamins C and E when taken in combination, yielding a more potent radical scavenging action. That is, adding a third antioxidant (rutin) creates a combined effect greater than the sum of the parts (Negre-Salvayre, 1991).

Some Major Antioxidant Herbs

Antioxidant factors found in plants are based upon constituent nutrients with demonstrated radical-scavenging capacities as well as upon non-vitamin or mineral substances. So, in addition to alpha-tocopherol, ascorbate, Carotenoids, and zinc, plant-based medicines may contain flavonoids, polyphenols, and flavoproteins. Further, some plants or specific.
combinations of herbs in formulations may act as antioxidants by exerting superoxide scavenging activity (Pronai, 1991) or by increasing superoxide dismutase (SOD) activity in various tissue sites (Liu, 1990). Each of these groups of compounds are substances that may exert that cell-protective action by more than one biochemical mechanism (Dragsted, 1993).

In addition to antioxidant properties per se, cancer-protective factors are found in many plants, including some fruits, vegetables, and commonly used spices and herbs. They can be divided into several different groups, based on their chemical structure, e.g., polyphenols, thiols, Carotenoids and retinoids, carbohydrates, trace metals, terpenes, tocopherols and degradation products of glucosinolates (i.e., isothiocyanates, indoles and dihydrodiols) and others. Among each of these groups of compounds are substances, which may exert their cancer-protective action by more than one biochemical mechanism. The biochemical processes of carcinogenesis are still not known in detail and probably varies with the cancer disease in question. Accordingly, the description of the biochemical backgrounds for the actions of cancer-protective factors must be based on a simplified model of the process of carcinogenesis. The model used in this presentation is a generalized initiation-promotion-conversion model, in which initiators are thought to be directly or indirectly genotoxic, promoters are visualized as substances capable of inferring a growth advantage on initiated cells and converters are believed to be genotoxic, e.g. mutagens, clastogens, recombinogens or the like. Experimental evidence for the mechanisms of action of cancer-protective agents in fruits and vegetables that protect against initiation include the scavenging effects of polyphenols on activated mutagens and carcinogens, the quenching of singlet oxygen and radicals by Carotenoids, the antioxidant effects of many compounds including ascorbic acid and polyphenols, the inhibition of activating enzymes by some flavonols and tannins, the induction of oxidation and of conjugation (protective) enzymes by indoles, isothiocyanates and dithiothiones, the shielding of sensitive structures by some polyphenols and the stimulation of DNA-repair exerted by sulphur-containing compounds. Mechanisms at the biochemical level in antipromotion include the antioxidant effects of Carotenoids and the membrane stabilizing effects reported with polyphenols, the inhibition of proteases caused by compounds from soybeans, the stimulation of immune responses seen with Carotenoids and ascorbic acid, and the inhibition of ornithine decarboxylase by polyphenols and Carotenoids. A few inhibitors of conversion have been identified experimentally, and it can be argued on a theoretical basis, that many inhibitors of initiation should also be efficient against conversion. The mechanisms of anticarcinogenic substances in fruits and vegetables are discussed in the light of cancer prevention and inhibition (Dragsted, 1993).

Plant antioxidants are more than mere supporting players in the battle against cellular damage and disease. As folklore has long instructed, certain plants play specific roles in disease prevention and treatment. A well known hepatic antioxidant, silymarin, from the milk thistle (Silybum marianum), for example, inhibits liver damage by scavenging free radicals among other mechanisms (Hikino & Kiso, 1988). This powerful antioxidant protects the liver against alcohol and pharmaceutical injury and even poisoning from extremely toxic compounds found in the Deathcap mushroom, Amanita phalloides. Interestingly, the Amanita toxins are not thought to be neutralized via any free-radical scavenging effects. Rather, it is theorized that silymarin competes with the Amanita toxins for the identical receptor on cell membranes (Hikino & Kiso, 1988). Here again, contemporary laboratory science confirms and elucidates the liver-protecting attributes of milk thistle, well known to folk medicine for 2,000 years.

GINGER

Scientific Name: Zingiber officinale
Parts Used: Rhizome
Dosage: 1 ounce of rhizome to 1 pint of water. Boil the water separately, then pour over the plant material and steep for 5 to 20 minutes, depending on the desired effect. Drink hot or warm, 1 to 2 cups per day.

Recent Scientific Findings
Currently, Ginger has received new attention as an aid to prevent nausea from motion
sickness. Ginger tea has long been an American herbal remedy for coughs and asthma, related to allergy or inflammation; the creation of the soft drink ginger ale, sprang from the common folkloric usage of this herb, and still today remains a popular beverage for the relief of stomach upset. Externally, Ginger is a rubefacient, and has been credited in this connection with relieving headache and toothache.

The mechanism by which Ginger produces anti-inflammatory activity is that of the typical NSAID (non-steroidal anti-inflammatory drug). This common spice is a more biologically active prostaglandin inhibitor (via cyclo-oxygenase inhibition) than onion and Garlic. By slowing associated biochemical pathways an inflammatory reaction is curtailed. In one study, Danish women between the ages of 25 to 65 years, consumed either 70 grams raw onion or 5 grams raw ginger daily for a period of one week. The author measured thromboxane production and discovered that ginger, more clearly than onion, reduced thromboxane production by almost 60%. This confirms the Ayurvedic "prescription" for this common spice and its anti-aggregatory effects.

By reducing blood platelet "clumping," Ginger, Onion and Garlic may reduce our risk of heart attack or stroke. In a series of experiments with rats, scientists from Japan discovered that extracts of Ginger inhibited gastric lesions by up to 97%. The authors concluded that the folkloric usage of Ginger in stomachic preparations was effective due to the constituents zingiberene, the main terpenoid, and 6-gingerol, the pungent principle.

**GINKGO**

**Scientific Name:** Ginkgo biloba

**Parts Used:** Leaves

**Dosage:** Approximately 1/2 ounce of leaves to 1 pint of water. Boil water separately and pour over the plant material and steep for 5 to 20 minutes, depending on the desired effect. Drink hot or warm, 1 to 2 cups per day, at bedtime and upon waking.

**Recent Scientific Findings**

The free-radical scavenging properties of Ginkgo biloba extract have been demonstrated as being at least as effective as uric acid, a potent, naturally occurring antioxidant. The plant extract has the further capacity to inhibit the formation of radicals that uric acid does not effect (Pinchemail, 1988, in E.W. Funfgeld, 1988).

Ginkgo research has proceeded in many other areas. The most interesting and important relate to vascular diseases, brain function, impotency, dopamine synthesis, inflammation, and asthma.

An extract from Ginkgo leaves is marketed as Tebonin. Clinical research has shown that Tebonin achieves vasodilation and improved blood flow, especially in deeper-seated medium and small arteries. The flow rate in capillary vessels and end arteries is increased. In elderly subjects, Tebonin alleviated dizziness and loss of memory. Ginkgo has proven to be a particularly valuable geriatric drug.

Mild memory loss continues to be one of humankind's tragedies and one of medicine's greatest challenges. Interestingly, ginkgolides and a bilobalide possess a structure that is unique in the vegetable kingdom. A double-blind, placebo controlled study shows yet another powerful benefit from this ancient Chinese herbal medicine.

Thirty-one patients showing mild to moderate memory impairment were followed for six months while taking a standardized extract of Ginkgo biloba extract (GBE). (All were over the age of 50.) The extract con-
tained 24% flavonoid glycosides and 6% terpenes. The results show that GBE "has a beneficial effect on mental efficiency in elderly patients showing mild to moderate memory impairment of organic origin."

Sixty patients suffering from arterial erectile dysfunction received a daily treatment with 60 mg. of an extract of Ginkgo biloba. After 6 months, 50% of the subjects once again were able to achieve penile erections. Upwards of 45% of the remaining subjects showed some improvement.

Another study found that Ginkgo biloba extract (GBE) might prevent radical mediated human kidney and liver damage caused by Cyclosporin A, an immunosuppressive drug used in transplants. This herbal product was found to be as effective as vitamin E and glutathione in protecting against such damage, adding to our understanding of the value of incorporating nutritional and herbal supplements in modern medicine. The protective effects of GBE were diminished in the presence of iron, owing to the limits imposed by this powerful oxidant.

Ginkgo's effect as an anti-allergic, anti-asthmatic agent has also been demonstrated. The platelet activating factor (PAF) has been implicated in pathophysiological states including allergic inflammation, anaphylactic shock, and asthma. One study concluded that Gingkolide B is the most active PAF antagonist found in this class of ginkkolides. It appears that Ginkgo relieves broncho-constriction due to its PAF antagonist activity. A randomized, double-blind, placebo-controlled crossover study in 8 atopic asthmatic patients showed that Ginkgo achieved significant inhibition of the bronchial allergen challenge compared to placebo.

LICORICE

Scientific Name: Glycyrrhiza glabra
Parts Used: Root
Dosage: 1 teaspoon of the root or subterranean stem, boiled in a covered container with 1 -1/2 pints of water for about 1/2 hour, at a slow boil. Allow liquid to cool slowly in the closed container. Drink cold, 1 swallow or 1 tablespoon at a time, 1 to 2 cups per day.

Recent Scientific Findings

The multitude of pharmacological effects of Licorice rhizomes and roots are practically all attributed to the presence of a triterpene saponin called glycyrrhizin, which is about fifty times sweeter than sugar, and has a powerful cortisone-like effect. Several cases have been reported in medical literature in which humans ingesting 6-8 ounces (a very large amount) of licorice candy daily for a period of several weeks are "poisoned" due to the cortisone-like effects of licorice extract in the candy. Proper treatment restores patients to normal. The above amount of this compound is very large compared with the relatively small amount found in supplements.

In addition, Licorice rhizomes and roots have a high mucilage content. When mixed with water, the resulting preparation has a very pleasant odor and taste, and acts as an effective demulcent on irritated mucous membranes, such as accompany a sore throat. One study found that glycyrrhizin was as effective a cough suppressant as codeine. A 1991 experiment with mice found that glycyrrhizin protected against skin cancer. The authors speculated that it might prove useful in protecting against some forms of human cancer as well.

It is not surprising that Licorice and glycyrrhizin have such wide applications. It should be noted that this chemical constitutes only 7 to 10% of the total root (on a dry weight basis). Glycyrrhetic acid (G.A.) is obtained when acid hydrolysis is applied to the main component of licorice. This compound is extensively used in Europe for its anti-inflammatory properties, especially in Addison's disease and peptic ulcer. Some European researchers concluded that G.A. may be preferred to cortisone because it is safer, especially when prolonged treatment is required.

A recent study (1990) demonstrated that G.A. exerts its activity not as a direct effect but by reducing the conversion of Cortisol to cortisone, its biologically inactive product. The authors concluded that hydrocortisone, a "weak anti-inflammatory agent," can be greatly potentiated (i.e., made more powerful) by the addition of 2% GA. To lessen the toxic effects of corticosteroids, the authors suggested that patients use hydrocortisone together with GA. Here is another example of the growing marriage between prescription pharmaceuticals and herbal preparations.

Glycyrrhizin has also exhibited anti-viral activity. A 1979 study demonstrated that
glycyrrhizin inhibited Epstein-Barr Virus (EBV), cytomegalovirus (CMV), and hepatitis B virus. In Japan, glycyrrhizin has long been successfully used to treat chronic hepatitis B. This has led to speculation that glycyrrhizin holds promise in the treatment of HIV.

A note of caution: Side effects from the ingestion of large amounts of Licorice have been reported. Glycyrrhizin in very large amounts can promote hypokalemia and hypertension. For these reasons people with heart problems and high blood pressure are advised to avoid consuming large quantities of Licorice or its components.

SCHIZANDRA
Scientific Name: Schizandra chinensis
Parts Used: Berry
Dosage: 1 to 2 grams per day in tablet or capsule form.

Recent Scientific Findings
This interesting plant has many biological activities including: anti-bacterial (equivocal results), sympatho-mimetic (stimulant), resistance stimulation, liver-protective, anti-toxic, anti-allergenic, antidepressant, glycogene-sis stimulant, and antioxidant effects.

In addition, and perhaps most interesting from the point of view of it being a folkloric "tonic," this herb protected against the narcotic and sedative effects of alcohol (ETOH) and pentobarbital (PB) and exposure to the highly toxic ether, in mice. As a result of these data, the authors concluded that Schizandra may be a useful clinical agent for reversal of CNS depression.

They based this antidepressant activity on the reasoning that depression may be due, in part, to adrenergic exhaustion following severe psychogenic stress. It is known that MAO (monoamine oxidase) inhibitors, as well as other selected compounds that increase noradrenergic neurotransmission within the CNS (such as imipramine), have proven benefit in depression.

This herb is also being promoted for its stimulating effect on the nervous system without being excitatory like amphetamine or caffeine. There are some proponents who claim "the higher the degree of exhaustion, the greater is the stimulating effect."

A very interesting study on performance in race horses tends to confirm the folkloric claims. Polo horses given the berry extract of this species showed a lower increase in heart rate (during exercise), a quicker recovery of respiratory function, a reduction of plasma lactate, and improved performance.

A 1990 study reported that a lignan component of Schizandra fruit suppresses the arachidonic (AA) cascade in macrophages. The AA cascade pushes the production of leukotrienes, which may play a role in inflammatory diseases. By inhibiting the arachidonic acid cascade, Schizandra both protects the liver and stimulates the immune system—two key roles of an ideal adaptogen.

An interesting non-Western 1991 study tested the "tonifying and invigorating yang" powers of Schizandra and other herbs in mice. The researchers measured the animals body weight, thymus weight, leukocyte count, and other parameters of "yang." They observed a direct correlation between the amount of herb ingested (as hot water extracts) and improved immunocompetence. They also noticed a distinct anti-fatigue quality, which was measured by reduced excitability of the parasympathetic nervous system. No toxicity was reported. The antioxidant activity of dibenzo-cyclo-octene lignans isolated from species found in the Schizandra family were reported in a 1992 study (Lu, 1992).

It appears that this creeping herb from the Far East has valid claims to the title of a "new" anti-fatigue agent which possibly helps to accelerate restorative processes within the human body. Traditional Chinese Medicine continues to offer new candidates to the annals of World Medicine. As we in the West are slowly learning, "traditional" or "folk" medicine really is the medicine of the people. Caution: While Schizandra is a very safe herb with much historical usage one supplier of a standardized extract recommends that this herb be avoided by: epileptics, those with high intracranial pressure or severe hypertension, and those with "high acidity."

TURMERIC
Scientific Name: Curcuma longa
Parts Used: Rhizome
Dosage: 1 to 2 grams per day in food or take capsules/tablets.

Recent Scientific Findings
Currently, Turmeric is used in India to treat anorexia, liver disorders, cough, diabetic
wounds, rheumatism, and sinusitis. In one study
Turmeric extract was tested for its
anticarcinogenic and antimutagenic properties.
Laboratory (non-human) experiments it was
found that this ancient spice reduced both the
number of tumors in mice and the mutagenicity of
benzo(a)pyrene (BP) and two other potent
mutagens, NPD and DMBA.

Preventing cancer now receives the attention it
has long deserved. Numerous biochemical and
epidemiological studies have demonstrated diet's
role in modulating the development of cancer.
Laboratory experiments have established that the
active principle of Turmeric (curcumin) is a
potent antimutagenic agent.

For those interested in how curcumin may act
to prevent cancer we turn again to the by-now all
pervasive theory of free-radical inactivation. The
test carcinogens BP and DMBA are metabolically
activated to proximate mutagenic/carcinogenic
epoxides, which then bind to macromolecules.
One study's authors concluded that since
curcumin is a potent antioxidant, it may scavenge
the epoxides and prevent binding to
macromolecules. In other words, this spice's
cell-protective properties are similar to nutrient
antioxidants, vitamins C and E, which inhibit free
radical reactions.

This type of herb is known as a non-steroidal
anti-inflammatory (NSAID). Curcumin inhibits
cycloxygenase and lipoxygenase enzymes.
Curcumin has three main mechanisms of action:
1) antioxidant activity; 2) lipoxygenase inhibitor;
and 3) cycloxygenase inhibition. By inhibiting the
associated biochemical pathways, inflammation is
curtailed. Modern science thus confirms what
traditional healers have known for centuries.
Namely, that the fresh juice from the rhizome will
reduce swelling in recent bruises, wounds and
insect bites; and that the dried powdered root kills
parasites, relieves head colds and arthritic aches.
(Interestingly, this spice has sometimes been used
to adulterate ginger.)

A 1991 pharmacological review confirmed
many of Turmeric's folkloric effects, including
wound healing, gastric mucosa protection,
antispasmodic activity, reduction of intestinal gas
formation, protection of liver cells, increasing bile
production, diminishing platelet aggregation (i.e.
blood clumping), lowering serum cholesterol (at
very high doses), antibacterial properties,
antifungal properties,
and potential antitumor activity. While most of
the above effects were demonstrated with
intravenous extracts in animals, they do parallel
treatment in humans and are not to be
dismissed as "experimental" or "trivial." Turmeric's benefits for arthritis treatment have
been demonstrated in human clinical trials. A
herbal formula of Turmeric, Ashwagandha, and
Boswellin was evaluated in a randomized, double-
blind, placebo-controlled study. After a one-
month evaluation period 12 patients with
osteoarthritis were given the herbal formula or
placebo for three months. The patients were
evaluated every two weeks. After a 15 day wash-
out period, the treatment was reversed with the
placebo patients receiving the drug and vice versa.
Again results were evaluated over a three month
period. The patients treated with the herbal
formula showed a significant drop in severity of
pain and disability score.

QUERCITIN
(A natural flavone derivative widely distributed in
the plant world.)

Quercitin is the commonest flavonoid in higher
plants. It is usually present as a glycoside
(example: rutin, isoquercitin, quercitin, hyperin,
and quercimeritrin), but is also isolated in the free
state from the families Compositae, Passiflorae,
Rhamna-ceae, and Solanaceae (where it mainly
occurs on leaf surfaces, in fruits, and in bud
effects) (Harborne & Baxter, 1993).

Quercitin is a powerful antioxidant that
decreases the concentration of superoxide anions
in enzymic and nonenzymic systems. A recent
animal study demonstrated antiulcer and
gastroprotective effects, especially against ethanol
injury. The cyto-protective activity was effected
through several interacting pathways involving
stimulation of prostaglandin and inhibition of
leukotriene production and through Quercitin's
antioxidant properties. Pretreating the
experimental animals with 200 mg/kg (a very high
dose!) 120 minutes before administering ethanol
was found to be the most effective dosage in
prevention necrosis (Alarcon de la Lastra, 1994).

Commonly Known Antioxidant Plants
Hundreds of plants have been studied and
found to possess antioxidant properties. The
following list consists of the English names of
Herbal Antioxidants in Clinical Practice

some you may be familiar with.

plantain
cumin
American
ginseng
leek
turmeric
ginseng
onion
lemongrass
Siberian
garlic
ginger
yam
cumin
ginseng
turmeric
garlic
American
leek
Siberian
garlic
cumin
ginseng
onion
leaves
garlic
Siberian
beans (green, black, red, etc.)
peanut
licorice
allspice
bearberry
ivy
anise
areca nut
elecampane
betel leaf
horseradish
nettle
black pepper
tarragon
Bay laurel, evergreen
tarragon
Bay laurel, evergreen
mugwort
Angelica
knight
mugwort
oats
motherwort
borage
hoarhound
frankincense
tea (black, green, and white)
bell peppers
(white, red, yellow, orange)
pepper
paprika
pimento,
calcium, etc.)
papaya
black pepper
onion
black pepper
cinnamon
myrtille
espresso
citrus
chile,
rosemary
black pepper
cranberry
tarragon
Bay laurel, evergreen
tarragon
Bay laurel, evergreen
mugwort
Angelica
knight
mugwort
oats
motherwort
borage
hoarhound
frankincense
tea (black, green, and white)
bell peppers
(white, red, yellow, orange)
pepper
paprika
pimento,
calcium, etc.)
papaya
black pepper
onion
black pepper
cinnamon
myrtille
espresso
citrus
chile,
rosemary
black pepper
cranberry
ginger

General References

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Ginger


Ginkgo

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**Milk Thistle**


**Licorice**


Herbal Antioxidants in Clinical Practice


Quercitin

Schizandra

Turmeric
3. Donatus, I.A., Sardjoko, & Vermeulen, N.P. Cytotoxic and cytoprotective activities of


