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GINKGO BILOBA

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Ginkgo biloba is an herb with a wide range of medicinal and therapeutic properties. In this issue of ***The Herbal Pharm***, we will discuss Ginkgo's unique history as well as its active ingredients, mechanisms of action and its clinical uses. Understanding **Ginkgo biloba's pharmacology and its therapeutic effects should enable you to make it one of the best-selling products in your stores**.

History:

Ginkgo biloba is the **oldest living tree species on the planet**. Fossil records show that Ginkgo trees were growing on the earth about **300 million years ago**. It is the only surviving member of a prehistoric family of trees. As a result, Ginkgo is the only member of its species, genus, family, order and class. No other living thing has such a singular distinction. Individual trees may live as long as one thousand years, grow to a height of over one hundred feet and have a diameter of three to four feet.

Ginkgo trees have been close to extinction several times. The last global **Ice Age destroyed most Ginkgo trees throughout the world**, but some trees managed to survive in China. Two thousand years ago the advancement of civilization in China almost drove Ginkgo into extinction again, but it was saved by Chinese monks who planted it around their temples because they considered Ginkgo to be a sacred tree. One of Ginkgo's unique attributes is that when it is exposed to high temperatures, it secretes a sap that has fire retardant properties. It is thought that this protective quality is one reason why Ginkgo trees were planted in such great numbers surrounding many of the Buddhist temples throughout China and Japan.

Because the leaves of the Ginkgo resemble the maidenhair fern, it is sometimes called the maidenhair tree. Ginkgo is a pretty, ornamental tree with unique, beautifully-shaped leaves. Ginkgo leaves have veins that fan out into two distinct halves, which bear a slight **resemblance to the two hemispheres of a human brain. Hence, its name, Ginkgo biloba (bi-lobal)**. Ginkgo grows prominently in the southern and eastern U.S. and in China. However, these days Ginkgo trees line the streets in many cities around the world. Powerful antioxidant compounds in the Ginkgo tree are thought to be responsible for the tree's hardiness and ability to thrive in polluted city environments.

Today, Ginkgo biloba is one of the **most widely prescribed herbals or pharmaceuticals in Europe** and is the number one drug in **Germany with more than 5.24 million prescriptions** written (Schwabe and Paffrath, 1991). Worldwide sales of Ginkgo total nearly **600 million US dollars**.

Active Ingredients:

The therapeutic benefits of Ginkgo leaves primarily come from two major groups of constituents: a) Ginkgo-flavone glycosides (flavonoid compounds that only occur in Ginkgo), and b) several terpene lactones (Ginkgolides and bilobalide), which are also unique to Ginkgo. Other minor constituents of Ginkgo include proanthocyanidins and various organic acids and sugars.

Standardization of Ginkgo:

Ginkgo biloba extract (GBE) is standardized to contain approximately **24% flavone glycosides and 6% terpene lactones**. These compounds are extracted from the tree's healthy green leaves. Specific methods of growing, harvesting and extraction have been developed. This makes it possible to confirm that undesirable substances have been eliminated and that exact amounts of the active ingredients have been extracted. Standardizing Ginkgo to a specific percentage of its active ingredients is called a chemical standardization. Scientists in Germany have shown that, in addition to a chemical standardization, a biological standardization of Ginkgo is also feasible. In this type of process, Ginkgo biloba extracts would be standardized according to their biological activity rather than by the amount of a specific ingredient. However, at this time, the chemical standardization procedure remains the accepted method.

The **flavone glycosides** in Ginkgo are primarily composed of quercetin, kaempferol, and isorhamnetin. The standardization process produces a specific balance of these three bioflavonoids. Smaller quantities of other flavonoid compounds known as proanthocyanidins also occur naturally in Ginkgo. These bioflavonoid compounds are responsible for Ginkgo's **antioxidant activity and its ability to inhibit platelet aggregation (sticking together)**.

The **terpene lactones** in Ginkgo consist of Ginkgolides A, B, C and J, and a similar compound named bilobalide. The **Ginkgolides, which do not occur in any other living plants, increase circulation and inhibit platelet-activating factor (PAF)**. Studies show that bilobalide exerts a protective effect on cells in the nervous system and it may also help regenerate damaged nerve cells.

MECHANISMS OF ACTION

Antioxidant Activity:

One of the important attributes of Ginkgo biloba extract products is their powerful antioxidant activity. The bioflavonoid constituents (the flavone glycosides) are thought to be the compounds that provide Ginkgo's antioxidant effects. Ginkgo has been shown to be **active against a wide variety of free radicals and free radical generating substances including nitric oxide, the superoxide, hydroxyl, oxoferryl and peroxyl radicals.[1,2] Ginkgo's antioxidant properties help protect the brain, retina of the eyes and the cardiovascular system against free radical aging damage**.

Lipid Peroxidation:

Ginkgo biloba extract is a powerful protector against lipid peroxidation, which is the most prevalent type of free radical reaction that occurs in the body. In fact, lipid peroxidation, which takes place primarily in cellular membranes, is the primary **cause of the aging process**. To a large degree, an individual's overall health is determined by the quality and condition of the cellular membranes. There is a tremendous amount of biochemical "work" that takes place on the surface of cellular membranes. At the same time, cellular membranes also determine what enters into cells; therefore they also play a key role in regulating all the biochemical activity that occurs inside the cells.

Ginkgo biloba's ability to prevent lipid peroxidation in cellular membranes makes it an important substance for **normalizing cellular function and slowing down the aging process**. Ginkgo's antioxidant properties and its related ability to prevent lipid peroxidation are responsible for its ability to enhance and protect cellular membrane function and integrity.

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[1] Marcocco L, et al. Antioxidant action of Ginkgo biloba extract Egb 761. Methods Enzymol 1994;234:462-475.

[2] Maitra I, et al. Peroxyl radical scavenging activity of Ginkgo biloba extract Ebb 761. Bilchem Pharmacol 1995 May 26;49(11):1649-1655.

In one study, Ginkgo's ability to prevent lipid peroxidation was compared with a variety of other water-soluble (vitamin C, glutathione and uric acid) and fat-soluble (vitamin E and vitamin A) antioxidants. The results showed that **Ginkgo was more effective than the water-soluble antioxidants and as effective as the fat-soluble antioxidants**.[3]

Radiation Protection:

A unique aspect of Ginkgo's antioxidant activity is its ability to **protect against radiation damage**. Exposure to radiation, either as therapy or by accident, creates compounds in the body that are called clastogenic factors. **Clastogenic factors are defined as substances that cause breaks in chromosomes**. This type of genetic damage often leads to cancer. Researchers have discovered that salvage personnel who worked to clean up the aftermath of the disaster at the **Chernobyl nuclear reactor in Russia** have a high percentage of clastogenic factors in their bodies. A group of these workers were treated with Ginkgo biloba extract (40 mg TID) for two months, at the end of which time the **clastogenic activity of their plasma was reduced to normal**.[4] A follow-up evaluation revealed that benefits from the two-month treatment with Ginkgo were maintained for an additional seven months. After one year, clastogenic factors were again present in one-third of the workers. Although the problem resurfaced in some workers, researchers were impressed by Ginkgo's ability to reduce radiation-induced chromosome breakage for a significant period of time, even after dosing with Ginkgo was discontinued.

PAF Inhibition:

Another important protective benefit from Ginkgo comes from its ability to inhibit a substance called platelet-activating factor (PAF). **Platelet-activating factor is a powerful pro-inflammatory agent that is produced by numerous cell types such as neutrophils, monocytes, macrophages and endothelial cells**, to name a few. When PAF is released, it causes platelets to clump or stick together. This is called platelet aggregation. Elevated levels of PAF can also **damage nerve cells, decrease blood flow and cause bronchial constriction and other similar inflammatory conditions**. It is recognized that PAF is released during shock and ischemic injury (temporary lack of blood supply) and that PAF antagonists are especially important because of their ability to **protect the heart and brain against these types of injuries**.

Research on the biochemical effects of the terpene fractions of Ginkgo is still relatively new. However, one of the terpene components of Ginkgo biloba, **Ginkgolide B, has been found to be a potent platelet-activating factor antagonist**. One of its most important attributes in this capacity is its ability to protect cells in the central nervous system against damage during **hypoxia, ischemia and seizures**.[5] Platelet-activating antagonists are going to be a huge new category of drugs in the pharmaceutical industry. Currently, approximately **25 drug companies have over 50 PAF-receptor antagonists in various phases of development**.[6] Although Ginkgo biloba extract is a powerful, natural PAF-receptor antagonist without side effects, drug companies are not interested in it because it is a natural product that cannot be patented.

Increased Circulation:

[3] Kose K, Dogan P. Lipoperoxidation induced by hydrogen peroxide in human erythrocyte membranes. 2. Comparison of the antioxidant effect of Ginkgo biloba extract (Egb 761) with those of water-soluble and lipid-soluble antioxidants. J Int Med Res 1995 Jan;23(1):9-18.
[4] Emerit I, et al. Clastogenic factors in the plasma of Chernobyl accident recovery workers: anticlastogenic effect of Ginkgo biloba extract. Radiat Res 1995 Nov;144(2):198-205.
[5] Smith PF, et al. The neuroprotective properties of the Ginkgo biloba leaf: a review of the possible relationship to platelet-activating factor (PAF). J Ethnopharmacol 1996 Mar;50(3):131-139.
[6] Negro AJM, et al. Platelet-activating factor antagonists. Allergol Immunopathol (Madr) 1997 Sep;25(5):249-258.

Numerous studies have documented the fact that extracts of **Ginkgo biloba improve circulation**. Ginkgo has been shown to have a **vasoregulatory impact on both the arteries and veins**. Although there are several mechanisms involved, one of Ginkgo's primary effects is the stimulation of the release of vascular relaxing factors such as endothelium-derived relaxing factor (EDRF) and prostacycline.[7] One of Ginkgo's most unique attributes is its ability to enhance circulation to the microcapillaries.[8] **Enhanced microcirculation provides a greater level of protection to tissues in various parts of the body such as the brain, heart and extremities**.

CLINICAL APPLICATIONS

Ginkgo's unique pharmacological effects make it useful in a substantial number of clinical conditions. Conditions that have benefited from the use of Ginkgo therapy include **Alzheimer's disease, atherosclerosis, cerebrovascular insufficiency, intermittent claudication, depression, diabetes, macular degeneration, male impotence and sexual dysfunction, PMS, tinnitus, asthma, vertigo, acute cochlear deafness and cognitive enhancement**.

Alzheimer's disease:

Current figures show that over four million people in the United States now have Alzheimer's disease. By the year 2040, that figure is expected to rise to 14 million.[9]

Numerous studies report that Ginkgo biloba extract provides some help to individuals with mild to moderate Alzheimer's disease. However, many of these studies were for short periods of time, had a small number of participants or did not include standard assessments of cognition and behavior. In order to better assess Ginkgo's effectiveness in treating Alzheimer's disease, a large multicenter, year-long, double-blind, placebo-controlled trial was conducted. In their conclusions, the authors stated the following. "**Ginkgo was safe and appears capable of stabilizing and, in a substantial number of cases, improving the cognitive performance and the social functioning of demented patients for six months to one year**."[10]

The results of numerous studies report that Ginkgo is more effective with patients who have mild to moderate Alzheimer's disease as compared to people with advanced stages of deterioration. The authors of studies frequently stress the importance of starting treatment with Ginkgo at the earliest sign of cognitive decline. Since Ginkgo is safe and since a fairly significant number of people do gain some degree of cognitive enhancement, it seems like an **appropriate therapy to use for anyone who is beginning to experience a loss of mental capacity**. In the concluding remarks of one review study, the authors state that, "**Ginkgo biloba extract might delay deterioration and enable these subjects to maintain a normal life and escape institutionalization**. In addition, Ginkgo biloba extract appears to be a safe drug, being well tolerated, even in doses many times higher than those usually recommended."[11]

Studies show that patients with Alzheimer's disease who respond to Ginkgo usually show improvements within the **first month of initiating therapy**. It is thought that there are several mechanisms of action at work. In addition to improving blood supply to the brain, studies also show that **Ginkgo increases the rate of information transfer between nerve cells**. Also, in aged animal models, Ginkgo has been shown to enhance **acetylcholine receptors and**

[7] Auguet M, et al. Pharmacological bases of the vascular impact of Ginkgo biloba extract. Presse Med 1986 Sep 25;15(31):1524-1528.
[8] Kiltringer P, et al. Microcirculation in parenteral Ginkgo biloba extract therapy. Wien Klin Wochenschr 1989 Mar 17;101(6):198-200.
[9] Brown, D., "Curbing Dementia with Ginkgo," Nutrition Science News, Oct. 1997, Vol. 2, No. 10:504.
[10] Le Bars PL, et al. A placebo-controlled, double-blind, randomized trial of an extract of Ginkgo biloba for dementia. North American Egb Study Group. JAMA 1997 Oct 22;278(16):1327-1332.
[11] Warburton DM. Clinical psychopharmacology of Ginkgo biloba extract. Press Med 1986 Sep 25;15(31):1595-1604.

increase cholinergic transmission.[12] These are important features in the treatment of Alzheimer's disease because the cognitive decline in these patients results from destruction of the cholinergic neurons.

Cerebrovascular insufficiency:

Atherosclerosis is the primary cause of cerebrovascular insufficiency. A meta-analysis was conducted to evaluate Ginkgo biloba's effectiveness in treating cerebrovascular insufficiency. All of the studies included in the analysis were double-blind, placebo-controlled. **Seven of eight studies that met the design criteria showed that Ginkgo produced significant improvements compared to placebo on all of the individual symptoms that were analyzed (one study was inconclusive).[13] The daily dosages ranged from 120 mg to 240 mg per day**.

Intermittent Claudication:

This condition is also referred to as peripheral vascular disease. Like cerebrovascular insufficiency, intermittent claudication is also due to atherosclerosis. Claudication is a term that means lameness or limping. The condition causes a severe pain, often described as a bad muscle cramp, in the calf of one or both legs during walking. The symptoms usually stop or diminish with rest. The pain is caused by the **lack of oxygen delivered to the tissues, the production of free radicals and increase in the production of cellular toxins**.[14]

Trental (pentoxifylline) is generally recognized as the drug of choice in the medical treatment of intermittent claudication. Although treatment with Trental does result in significant improvement, there are some major cautions and side effects associated with the drug. **Treatment with Ginkgo biloba produces results that are as good or better than Trental without any accompanying side effects and at about half the cost**. In an excellent review article comparing the effectiveness of Trental versus Ginkgo biloba extract, it was reported that **Trental improves total and pain-free walking distance by approximately 65% whereas patients taking Ginkgo increase their pain-free walking distance from 75% to 110% and increase maximum walking distance from 52.6% to 119%**.[15]

Depression:

In several studies, patients **with Alzheimer's disease who were treated with Ginkgo experienced a decrease in depression**. Several factors may be at work here. First, it has been shown that ingredients in the leaves of Ginkgo biloba exhibit **antidepressant properties through their ability to inhibit monoamine oxidase (MAO), with both MAO-A and MAO-B subtypes showing similar suppression**.[16] Another aspect of Ginkgo's antidepressant activity may be due in part to the fact that it produces improvement in cognitive abilities, which makes individuals feel better about being able to cope with the everyday demands of living.

In addition to Ginkgo's direct antidepressant activity, a newly discovered effect may also be playing a role. A recent study evaluated 39 patients who were physically healthy, but mentally

[12] Hofferberth B. The efficacy of Egb761 in patients with senile dementia of the Alzheimer's type: A double-blind, placebo-controlled study on different levels of investigation. Human Psychopharmacol 1994;9:215-222.
[13] Hopfenmuller W. Evidence for a therapeutic effect of Ginkgo biloba special extract. Meta-analysis of 11 clinical studies in patients with cerebrovascular insufficiency in old age. Arzneimittelforschung 1994 Sep;44(9):1005-1013.
[14] Belch JJ, et al. Free radical pathology in chronic arterial disease. Free Radic Biol Med 1989;6(4):375-378.
[15] No authors listed. Intermittent claudication: Trental vs. Ginkgo biloba extract. Am J of Nat Med 1995 Jan/Feb;2(1):10-13.
[16] White HL, et al. Extracts of Ginkgo biloba leaves inhibit monoamine oxidase. Life Sce 1996;58(16):1315-1321.

depressed. These patients exhibited a global reduction in regional cerebral blood flow compared with psychiatrically healthy controls. The depressed patients had decreased blood flow to the orbital frontal and inferior temporal areas on both sides of the brain and reduced cerebral blood flow to the right hemisphere.[17] Many studies have been published on Ginkgo's ability to increase cerebral blood flow. Therefore, it is possible that a significant portion of Ginkgo's antidepressant activity may be due to the herb's ability to stimulate blood flow to the brain, rather than from a direct chemical antidepressant effect of its ingredients.

Male Impotence & Sexual Dysfunction:

There is an ever-increasing incidence of **antidepressant-induced sexual dysfunction reported by both women and men**. This has proven to be one of the most disturbing side effects of the select serotonin reuptake inhibitors (SSRIs). However, patients also report sexual dysfunction associated with other classes of antidepressants including the serotonin and norepinephrine reuptake inhibitors (SNRIs), monoamine oxidase inhibitors (MAOIs), and tricyclics.

Ginkgo has been shown to be remarkably effective **(84% overall success) in treating SSRI-induced sexual dysfunction**. In a study that involved 33 women and 30 men, **women (91%) responded somewhat better than men (76%)**.[18] Patients treated with Ginkgo reported a positive effect on all four phases of the sexual response cycle which include desire, excitement (erection and lubrication), orgasm and resolution (afterglow). The dosages of Ginkgo biloba extract ranged from 60 mg daily to 120 mg twice daily. The possible pharmacological mechanisms involved in Ginkgo's success with SSRI-induced sexual dysfunction include its effects on platelet activating factor, prostaglandins, peripheral vasodilation and serotonin and norepinephrine receptor modulation.

It is interesting to note that this study originated because of a report from a **geriatric patient who noted improved erections while he was being treated with Ginkgo for memory enhancement**.

Diabetes:

Individuals with diabetes are known to have a higher incidence of illnesses related to circulatory problems. Two of the most serious conditions are **decreased peripheral vascular circulation, which sometimes progresses to gangrene and amputation, and eye problems which frequently progress to blindness**. Ginkgo can be helpful for diabetic patients because of its well-known ability to enhance peripheral circulation.

Ginkgo also shows promise in the **treatment of diabetic retinopathies**. Diabetes was chemically induced in a group of rats by the injection of alloxan. After two months of diabetes the electroretinographic studies revealed substantial retinal damage in the eyes of the diabetic rats compared to rats treated with Ginkgo. The authors suggest that **Ginkgo's protective effects are due to its antioxidant free radical scavenging properties**.[19]

Ginkgo biloba extract may play another important role in diabetic patients. An interesting study has shown that Ginkgo **enhances the electrical activity in the beta cells of the pancreas**. When Ginkgo was administered to mice with chemically-induced diabetes, the beta cells in the pancreas were protected against damage. Using intracellular microelectrodes, it was shown that

[17] Lesser IM, et al. Reduction of cerebral blood flow in older depressed patients. Arch Gen Psychiatry 1994 Sep;51(9):677-686.
[18] Cohen AJ, Bartlik B. Ginkgo biloba for antidepressant-induced sexual dysfunction. J Sex Marital Ther 1998 Apr;24(2):139-143.
[19] Doly M, et al. Effect of Ginkgo biloba extract on the electrophysiology of the isolated retina from a diabetic rat. Presse Med 1986 Sep 25;15(31):1480-1483.

Ginkgo-treated mice had increased beta cell electrical activity, which is an indicator of increased insulin secretion.[20]

Macular Degeneration:

A small, double-blind human study was conducted with 10 outpatients on Ginkgo's effectiveness in treating senile macular degeneration. In spite of the small number of patients in the trial, therapy with **Ginkgo produced a statistically significant improvement in long-distance visual acuity**. It is assumed that free radicals are a major cause of the pathogenesis in senile macular degeneration. Ginkgo's antioxidant activity is believed to be the mechanism involved.[21]

Premenstrual Syndrome (PMS):

The effectiveness of standardized Ginkgo biloba extract was studied in women experiencing congestive symptoms of premenstrual syndrome. This multicenter trial included **165 women between the ages of 18 to 45 who had been suffering for at least three cycles and during at least seven days per cycle**. The first cycle was used to diagnosis PMS. Then, during the following two cycles, the women received either Ginkgo or a placebo from the 16th day of the first cycle until the fifth day of the following cycle. A double rating system was employed using self-evaluation by the women and practitioner-evaluation during clinical visits during the premenstrual phase before and after the two cycles of treatment. Ginkgo proved significantly more effective than placebo in **treating the congestive symptoms of PMS, particularly breast symptoms**.[22]

Tinnitus:

This is a condition characterized by a subjective ringing or whistling sound in one or both ears. Although some studies have shown contradictory results, two positive studies will be reported here. Tinnitus was induced in laboratory rats by administering overdoses of sodium salicylate. Rats treated with **Ginkgo showed a significant decrease in the behavioral manifestations of tinnitus**.[23]

In a multicenter study with humans, E.N.T. specialists followed outpatients with tinnitus for a 13-month treatment period. The results of this study showed that treatment with Ginkgo biloba extract **improved the condition in all of the tinnitus patients under observation**.[24]

Cognitive enhancement:

Poor circulation decreases the supply of oxygen delivered to cells, creating a condition known as hypoxia. During hypoxia there is an increase in the generation of free radicals, which results in cellular damage. This is the **aging process, and when free radical damage destroys brain cells, there is a loss of cognitive function, which is ultimately diagnosed as senile dementia**.

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[20] Vasseur M, et al. Effects of repeated treatment with an extract of Ginkgo biloba (Egb 761), bilobalide and ginkgolide B on the electrical activity of pancreatic beta cells of normal or alloxan-diabetic mice: an ex vivo study with intracellular microelectrodes. Gen Pharmacol 1994 Jan;25(1):31-46.
[21] Lebuisson DA, et al. Treatment of senile macular degeneration with Ginkgo giloba extract. A preliminary double-blind drug vs. placebo study. Press Med 1986 Sep 25;15(31):1556-1558.
[22] Tamborini A, Taurelle R. Value of standardized Ginkgo biloba extract (EGb 761) in the management of congestive symptoms of premenstrual syndrome. Rev Fr Gynecol Obstet 1993 Jul;88(7-9):447-457.
[23] Jastreboff PJ, et al. Attenuation of salicylate-induced tinnitus by Ginkgo biloba extract in rats. Audiol Neurootol 1997 Jul;2(4):197-212.
[24] Meyer B. Multicenter randomized double-blind drug vs. placebo study of the treatment of tinnitus with Ginkgo biloba extract. Presse Med 1986 Sep 25;15(31):1562-1564.

Ginkgo has been shown to be quite effective in enhancing cognitive performance in elderly people with cerebral insufficiency. For example, in one study, **72 outpatients with cerebral insufficiency were randomized in a double-blind, placebo-controlled study lasting 24 weeks**. After six weeks, there was a statistically significant improvement in short-term memory in the Ginkgo group and no change in the placebo group. After 24 weeks, there was also a statistically **significant increase in the rate of learning**.[25] This study shows that Ginkgo increases both short-term memory and mental or learning performance.

Ginkgo's ability to protect against hypoxic damage is **not limited to the elderly population**. German researchers devised an ingenious method to create a hypoxic condition in healthy subjects without harming them. Results of the test demonstrated that Ginkgo was able to protect against the decrease in the rate of nerve impulse conduction that accompanies hypoxia. In this study, a number of activities that are controlled by the brain were monitored and measured. Under hypoxic conditions, voice response, **muscle control and respiration measurements were significantly better in Ginkgo-treated subjects compared to controls**.[26] This study shows that Ginkgo can provide **significant protection against brain aging for people of all ages**.

Short-Term Memory:

A double-blind study with healthy female volunteers documented Ginkgo's ability to improve short-term memory. The effect was not seen at lower doses (120 mg and 240 mg). However, when the women were given **600 mg of Ginkgo biloba extract and tested one hour later, the results showed a very significant improvement in short-term memory compared to women taking a placebo**.[27]

Stress Reduction:

Laboratory rats undergoing a learning process were subjected to a stressful situation (noise) that decreased their capacity and rate of learning. It was also shown that the stress caused a significant increase in the plasma concentrations of the major stress response hormones, adrenaline, norepinephrine and cortisone. The rats treated with Ginkgo learned better than the controls while being exposed to the stressful condition.[28] This shows that **Ginkgo can facilitate a favorable behavioral adaptation that enables the mind to think and learn better during a stressful situation**.

Mental Alertness:

Ginkgo affects mental alertness by actually changing the frequency of brain waves. In this double-blind study, EEG monitoring equipment recorded the patients' brain waves. The results showed that **Ginkgo increased the alpha waves** (the brain wave frequencies associated with mental alertness). The monitors also showed that **Ginkgo caused a decrease in theta brain waves** (the slower brain wave frequencies associated with lack of attention and an "unfocused"

[25] Grassel E. Effect of Ginkgo-biloba extract on mental performance. Double-blind study using computerized measurement conditions in patients with cerebral insufficiency. Fortschr Med 1992 Feb 20;110(5):73-76.
[26] Schaffler K, Reeh PW. Double blind study of the hypoxia protective effect of a standardized ginkgo biloba preparation after repeated administration in healthy subjects. Arzneimittelforschung 1985;35(8):1283-1286.
[27] Hindmarch I. Activity of Ginkgo biloba extract on short-term memory. Presse Med 1986 Sep 25;15(31):1592-1594.
[28] Rapin JR, et al. Demonstration of the "anti-stress" activity of an extract of Ginkgo biloba (EGb 761) using a discrimination learning task. Gen Pharmacol 1994 Sep;25(5):1009-1016.

state of mind).[29] The subjects in this study were elderly individuals (aged 57 to 77) who were exhibiting some signs of mental deterioration. Individuals with the most unfavorable EEG scores at the beginning of the trial exhibited the most improvement.

Summary:

Gingko biloba is an amazing herb from which standardized extracts of the tree's healthy green leaves can provide a wide range of beneficial effects. Its primary benefits are derived from its ability to **enhance circulation, stabilize cellular membranes, neutralize free radicals and protect the cells in the brain and central nervous system against aging damage**. These actions of Ginkgo make it a useful therapeutic agent for numerous clinical conditions. The two areas where Ginkgo is used most widely are in cardiovascular disease-related circulatory problems and cognitive decline in the elderly. However, it is important to realize that Ginkgo's benefits should not be relegated to the old and infirm.

To review, following are several conditions and applications for which Ginkgo biloba should be recommended:

- Students -- for short-term memory for tests
- Diabetics
- Everyone who wants an anti-aging product
- People exposed to radiation
  - Cancer patients
  - Healthcare providers who take x-rays
  - Dental providers who take x-rays
  - Anyone else exposed to x-rays
- Cardiovascular conditions
- Alzheimer's disease patients
- People who have intermittent claudication
- People who are depressed
- Those with sexual dysfunction or impotence
- Macular degeneration
- PMS
- Tinnitus
- Stress reduction
- Mental alertness
- Memory enhancement
- Many more

Ginkgo biloba is an herbal product that belongs in the categories of anti-aging and life extension. Ginkgo has been part of my daily nutritional supplement program for years. I frequently urge people to consider adding Ginkgo to their supplement program -- just for the health of it!

[29] Gessner B, et al. Study of the long-term action of a Ginkgo biloba extract on vigilance and mental performance as determined by means of quantitative pharmaco-EEG and psychometric measurements. Arzneimittelforschung 1985;35(9):1459-1465.