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Chapter 1 : Rethinking Ginkgo biloba L.: Medicinal uses and conservation

Sexual reproduction of Ginkgo provides a large number of plants quickly as well as a faster vegetative development than trees from cutting or grafting.

Non-commercial uses of the work are permitted without any further permission from Dove Medical Press Limited, provided the work is properly attributed. This article has been cited by other articles in PMC. Abstract Background Graphene is a novel two-dimensional planar nanocomposite material consisting of rings of carbon atoms with a hexagonal lattice structure. Graphene exhibits unique physical, chemical, mechanical, electrical, elasticity, and cytocompatible properties that lead to many potential biomedical applications. Nevertheless, the water-insoluble property of graphene restricts its application in various aspects of biomedical fields. Therefore, the objective of this work was to find a novel biological approach for an efficient method to synthesize water-soluble and cytocompatible graphene using Ginkgo biloba extract GbE as a reducing and stabilizing agent. In addition, we investigated the biocompatibility effects of graphene in MDA-MB human breast cancer cells. Biocompatibility of GO and Gb-rGO was assessed in human breast cancer cells using a series of assays, including cell viability, apoptosis, and alkaline phosphatase ALP activity. X-ray diffraction studies confirmed the crystalline nature of graphene. The formation of defects in Gb-rGO was confirmed by Raman spectroscopy. The biocompatibility of the prepared GO and Gb-rGO was investigated using a water-soluble tetrazolium 8 assay on human breast cancer cells. Conclusion In this work, a nontoxic natural reducing agent of GbE was used to prepare soluble graphene. The as-prepared Gb-rGO showed significant biocompatibility with human cancer cells. This simple, cost-effective, and green procedure offers an alternative route for large-scale production of rGO, and could be used for various biomedical applications, such as tissue engineering, drug delivery, biosensing, and molecular imaging. These properties provide graphene with great potential in various applications ranging from energy storage to biomedical materials. Further, Lee et al 18 reported that the noncovalent binding capability of graphene allows it to act as a preconcentration platform for osteogenic inducers, which accelerate mesenchymal stem cells growing on it toward the osteogenic lineage. Nayak et al 19 reported that graphene-treated human mesenchymal stem cells show enhanced proliferation and differentiation. Chen et al 20 reported that graphene and GO can support induced pluripotent stem cell culture and allow for spontaneous differentiation, and also suggested that the different surface properties of graphene and GO influence the performance of induced pluripotent stem cell culture and applications. The different physical and chemical properties could influence the biological responses of cells. The use of biological systems in this area is rapidly developing due to their ease of handling, availability, and nontoxicity. Moreover, biological synthesis of graphene is an environmentally friendly method without the use of harsh, toxic, and expensive chemicals. Generally, the most common synthesis of graphene has utilized chemical reducing agents, such as hydrazine, sodium citrate, and sodium borohydride to reduce GO, 24 , 25 which can lead to the absorption of harsh chemicals on the surfaces of nanoparticles, raising the toxicity issue. Currently, the green synthesis of graphene is being investigated to decrease the use of toxic chemicals and increase biocompatibility in biotechnology and biomedical applications. For the development of green chemistry, several biological materials, such as wild carrot root, 32 yeast, 33 Escherichia coli, 34 , 35 E. The organisms used in graphene synthesis vary from simple prokaryotic systems to complex eukaryotes. The biological synthesis of nanomaterials using plants has received more attention as a suitable alternative to chemical procedures and physical methods. These molecules play an important role in the bioreduction, formation, and stabilization of metal nanoparticles. Here, we explored the possibility of using G. All aqueous solutions were prepared with deionized water. All other chemicals were purchased from Sigma-Aldrich unless stated otherwise. Synthesis of graphene oxide The synthesis of GO was performed as described previously. The color of the mixture changed to brilliant yellow, indicating the oxidation of pristine Gt to GtO. The mixture was then filtered and washed with diluted HCl to remove metal

ions. Finally, the product was washed repeatedly with distilled water until pH 7. The sample of GtO was obtained after drying. To prepare GO, the synthesized GtO was redispersed in distilled water to create a yellow-brown dispersion, and the exfoliation of GtO to generate GO sheets was achieved by ultrasonication for 30 minutes. The resulting aqueous dispersion of the brown GO sheet was stable. Preparation of leaf extract Fresh G. Twenty grams of G. The finely cut G. After boiling, the mixture was filtered through Whatman grade 1 filter paper. The extract was used for synthesis of graphene. In the typical reduction experiment, 10 mL of G. Then, functionalized Gb-rGO was filtered and washed with deionized water. Finally, a black Gb-rGO dispersion was obtained. The dried powder was diluted with potassium bromide in a ratio of 1: The solid samples were transferred to a carbon tape held in an SEM sample holder for analyses. The analyses of the samples were carried out at an average working distance of 6 mm. All samples were deposited on glass slides in powder form without using any solvent. All experiments were performed in six-well plates, unless stated otherwise. The cells were washed with phosphate-buffered saline PBS; pH 7. Cell-viability assay A water-soluble tetrazolium WST -8 assay was performed as described previously in Liao et al. The absorbance of the mixture solutions was measured at nm using a microplate reader. Optical density was measured at nm. The cells were washed three times with PBS, and images were captured using a fluorescence microscope. Apoptotic cells were identified by features characteristic of apoptosis. The tests were performed in triplicate. Based on the terminal deoxynucleotidyl transferase-mediated deoxyuridine triphosphate nick-end labeling TUNEL reaction, apoptosis assay was performed, fluorescence detection of cells with apoptotic DNA strand breaks was performed. To examine total cell numbers, nuclei were labeled simultaneously with DAPI. The amount of released p-nitrophenol was measured at nm in a well microplate reader. Enzyme activity was evaluated as the amount of nitrophenol released through the enzymatic reaction, and absorbance was recorded using a microplate reader model ; Bio-Rad Laboratories, Hercules, CA, USA at nm. As shown in Figure 1 , after reduction, a homogeneous yellow-brown GO dispersion was converted to black, which indicates the transition of GO to graphene. The color of GO and Gb-rGO appear different because of their distinct structural and physicochemical properties. GO and Gb-rGO samples were analyzed. We also observed that the reduction was completed within 24 hours, because the peak shifted no more when the reaction time was extended. The disappearance of the peak at nm and the appearance of a new peak around nm emerged in the UV spectra of the Gb-rGO, suggesting that sp2 carbon was restored and atoms were possibly rearranged within Gb-rGO.

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Chapter 2 : Growing ginkgo from seed | Space for life

4 Cultivation of Ginkgo biloba on a Large Scale 63 Dominique Laurain 5 Plant Cell Biotechnology of Ginkgo 81 Large scale contracted mechanised cultivation with.

Ginkgo adiantoides or a new taxon from the USA, G. The most plausible ancestral group for the order Ginkgoales is the Pteridospermatophyta , also known as the "seed ferns"; specifically the order Peltaspermales. The closest living relatives of the clade are the cycads , [8]: Fossil plants with leaves that have more than four veins per segment have customarily been assigned to the taxon Ginkgo, while the taxon Baiera is used to classify those with fewer than four veins per segment. Sphenobaiera has been used for plants with a broadly wedge-shaped leaf that lacks a distinct leaf stem. Fossils attributable to the genus Ginkgo first appeared in the Early Jurassic. One of the earliest fossils ascribed to the Ginkgophyta is Trichopitys , distinguished by having multiple-forked leaves with cylindrical not flattened , thread-like ultimate divisions. The Ginkgophyta declined in diversity as the Cretaceous progressed, and by the Paleocene , Ginkgo adiantoides was the only Ginkgo species left in the Northern Hemisphere , while a markedly different and poorly documented form persisted in the Southern Hemisphere. Along with that of ferns, cycads, and cycadeoids, the species diversity in the genus Ginkgo drops through the Cretaceous, at the same time the flowering plants were on the rise; this supports the hypothesis that, over time, flowering plants with better adaptations to disturbance displaced Ginkgo and its associates. Limited number of species[edit] Fossil Ginkgo leaves from a Jurassic period formation in Scarborough , UK It is doubtful whether the Northern Hemisphere fossil species of Ginkgo can be reliably distinguished. Given the slow pace of evolution and morphological similarity between members of the genus, there may have been only one or two species existing in the Northern Hemisphere through the entirety of the Cenozoic: The remainder may have been ecotypes or subspecies. The implications would be that G. Extreme longevity; slow reproduction rate; in Cenozoic and later times a wide, apparently contiguous, but steadily contracting distribution; and as far as can be demonstrated from the fossil record extreme ecological conservatism restriction to disturbed streamside environments. Ginkgo evolved in an era before flowering plants, when ferns , cycads , and cycadeoids dominated disturbed streamside environments, forming low, open, shrubby canopies. The sediment record at the majority of fossil ginkgo localities indicates it grew primarily in disturbed environments , along streams and levees. The epithet of the latter may have been intended to denote a characteristic resembling Adiantum , the genus of maidenhair ferns. Engelbert Kaempfer , the first Westerner to investigate the species in , wrote down this pronunciation in the notes that he later used for the Amoenitates Exoticae with the "awkward" spelling "ginkgo". Horticulture[edit] Ginkgos are popular subjects for growing as penjing and bonsai ; [35] they can be kept artificially small and tended over centuries. Furthermore, the trees are easy to propagate from seed. Ginkgo seeds with sarcotesta removed Ginkgo seeds served with boiled coconut flesh as a dessert in Thailand The nut-like gametophytes inside the seeds are particularly esteemed in Asia, and are a traditional Chinese food. In Chinese culture, they are believed to have health benefits; some also consider them to have aphrodisiac qualities. Japanese cooks add ginkgo seeds called ginnan to dishes such as chawanmushi , and cooked seeds are often eaten along with other dishes. MPN is heat-stable and not destroyed by cooking. Some people are sensitive to the chemicals in the sarcotesta , the outer fleshy coating. These people should handle the seeds with care when preparing the seeds for consumption, wearing disposable gloves. The symptoms are allergic contact dermatitis [37] [38] or blisters similar to that caused by contact with poison ivy. However, seeds with the fleshy coating removed are mostly[clarification needed][quantify] safe to handle. Traditional medicine[edit] The first use as a medicine is recorded in the late 15th century in China; among western countries, its first registered medicinal use was in Germany in According to a systemic review , the effects of ginkgo on pregnant women may include increased bleeding time , and it should be avoided during lactation because of inadequate safety evidence. The level of these allergens in standardized pharmaceutical

preparations from Ginkgo biloba was restricted to 5 ppm by the Commission E of the former Federal German Health Authority. The first record of Europeans encountering it is in in Japanese temple gardens , where the tree was seen by the German botanist Engelbert Kaempfer. Because of its status in Buddhism and Confucianism , the ginkgo is also widely planted in Korea and parts of Japan; in both areas, some naturalization has occurred, with ginkgos seeding into natural forests. In some areas, most intentionally planted ginkgos are male cultivars grafted onto plants propagated from seed, because the male trees will not produce the malodorous seeds. The disadvantage of male Ginkgo biloba trees is that they are highly allergenic. The ginkgo leaf is the symbol of the Urasenke school of Japanese tea ceremony. The tree is the official tree of the Japanese capital of Tokyo , and the symbol of Tokyo is a ginkgo leaf. Although almost all other plants and animals in the area were killed, the ginkgos, though charred, survived and were soon healthy again, among other hibakujumoku trees that survived the blast. The six trees are still alive: The shrine is in the city of Kamakura , Kanagawa Prefecture , Japan.

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Chapter 3 : Conifers - Yamina Rare Plants

Ginkgo -- Therapeutic use. Ginkgo biloba. 4 Cultivation of Ginkgo biloba on a Large Scale 63 --Dominique Laurain Plant Cell Biotechnology of Ginkgo

Abstract Ginkgo biloba G. Palaeobotanical history showed a wide distribution of the species across the globe but declined over geological time, becoming restricted to narrow geographical range with few surviving individuals in the modern day. The tree is slow growing, adapted to many ecological conditions and shows numerous adaptation in developmental patterns. Medicinal use of the species is attracting research interest, especially the various parts of the tree that are used in orthodox or traditional medicine to treat diseases due to the many bioactive compounds. The primary compounds receiving increasing research interest are the triterpene lactones and flavonoids; these are the target of biotechnological strategies being employed to enhance production. Many genetic and environmental factors have contributed to the endangered status of the species; conservation measures are required to protect it from extinction. In many countries, the cultivation of plantations for the supply of ginkgo leaf-based pharmaceutical formulations is in progress, and efforts to standardize ginkgo leaf extract as herbal medication for human use are being made. Microcuttings and cuttings, cryopreservation, and plant tissue culture have all aided to conserve G. Bilobalides, conservation, Ginkgo biloba, ginkgolides, short shoots, triterpene lactones How to cite this article: Rethinking Ginkgo biloba L.: Medicinal uses and conservation. Its relationship with other plants is uncertain. As a result, it is classified in its own division: Ginkgophyta, having the extant species G. For this reason, the ginkgo is considered the "missing link" between gymnosperms and angiosperms. The plant shows high resistance to environmental stresses, microbial diseases fungal, viral, and bacterial , other pests, and gaseous pollutants ozone and SO 2 , making it suitable and relevant for planting in urban areas. Indeed, it can act as a model to study disease resistance and stress in plants. The ginkgo has tremendous medicinal, spiritual, and horticultural importance in Chinese culture. The supplements are bestselling herbal medications with a long history of use in traditional medicine to treat blood disorders; these are known to improve memory and offer the best-known way to keep the mind sharp. Leaves and seeds of G. Modern research focuses on the standardization of G. The tree produces biflavones, constituents in its leaves: Ginkgo leaf extract is used in medicine due to its therapeutic actions in regulating cerebral blood flow, protection against free radicals, and delaying the progress of dementia and diabetes. The range declined until 2 million years ago, when the trees were restricted to a small area in China. The most plausible ancestral group of the order Ginkgoales is Peltaspermales, while the closest living relatives of the clade are cycads that share the characteristics of motile sperm with the extant G. Evidence indicates that the decline was due to decreased temperatures. The vigorous young ginkgo tree is pyramidal with a principal central leader and wide-spaced whorls of lateral branches that grow out at a diagonal orientation to the trunk; increase in height slows at maturity when the tree fills out the sparse, branched juvenile structures in a spreading crown formation. The leaves are deciduous, petiolate, fan-shaped, bilobed, thickened at the margin, broader than they are long, dichotomous-veined, and arranged in an alternate or clustered fashion of on the short shoots. The catkins of males emerge before the leaves fall off and after pollen is shed, and pollination is facilitated by the wind, while the ovules of females are produced in pairs and borne at the ends of stalks mm long. Once inside, a male gametophyte undergoes 4 months of development that result in the production of a pair of multiflagellated spermatozoids. One of the spermatozoids fertilizes the egg cell while the ovule remains on the tree. Embryo maturation completes in weeks after seeds fall, and the foul odor from the fruits indicates that they are mature. The behavior of G. However, in "special trees," seeds produced on the leaves do not germinate because of the nondevelopment of the pollen chamber at the time pollen is shed, and the gametophyte in the leaf ovule does not accept sperm because of the desiccation of its cytoplasm and nucleus. The therapeutic effect and pharmacological action are due to the joint effect of multiple components, and no individual component is regarded to solely exert the effect. Novel

phytochemicals are terpenes and trilactones ginkgolides and bilobalides , flavonoids, and other compounds. Apart from this, two new diterpenoid compounds, ginkgolides P and Q are isolated from leaves. These two end products react to produce geranylgeranyl pyrophosphate, which converts to levopimaradiene, leading to the synthesis of dehydroabietane transported from plastids to the cytoplasm; this is in turn converted to ginkgolides through a series of oxidation reaction steps. The biosynthesis occurs in active-growing tissues and aerial parts of the ginkgo plant. The flavonoids are flavones, biflavones, flavonols, tannins, and associated glycosides, [51] which have antioxidant, antifeeding, and antinutritive action against insect herbivores; significant differential levels of quercetin and kaempferol are observed when Spodoptera littoralis feed upon ginkgo compared to instances of mechanical damage. The biflavones include amentoflavone, 5-methoxybilobetol, bilobetol, isoginkgetin, ginkgetin, and sciadopitysin. The few recent studies on the anticancer activity of the extract in in vitro models showed inhibited cell proliferation, tumor suppression, and DNA damage repair effect of the extract. Current interest focuses on the pharmacology, toxicology, and clinical research on the neuroprotective importance of ginkgo leaf extract. The pharmaceutical value of the extract is gaining increasing recognition, and efforts to standardize the extract are being made via incorporation into the pharmacopeia of many European countries. Standardization of the extract into dosage for safe human use as a herbal drug is facilitated by the regulatory agencies in these countries, and safety measures are taken. The recent and growing developments in studying the neuroprotective role of ginkgolides may, it is hoped, address the problems of clinical therapy of neurodegenerative diseases. Conservation, Cultivation, and Propagation The oldest ginkgo trees are found growing near Daoist and Buddhist temples: In Korea the ginkgo is cultivated for the beauty of its leaves, and for its edible and medicinal nuts; in parts of Japan it is widely planted according to its status in Confucianism. Male trees do not produce malodorous seeds. Although cultivated trees exist throughout the world, there is no certainty whether G. Propagation is achieved through application of in vitro microcuttings along with other tissue culture techniques. Several selections of G. These cultivated forms include ovulate trees that produce seeds attached to leaves, trees having a narrow and upright growth habit, trees with a spreading growth habit comprising exclusive horizontal branches, and an unstable form of trees having leaves striped with yellow or white. The propagation of the cultivars is by grafting on seedling rootstocks, and nuts are produced at 5 years along with light crops in alternate years. Among propagation methods, micropropagation by cuttings and microcuttings has aided the clonal propagation of Ginkgo trees. In vitro regeneration of the ginkgo shoot is derived from embryo and cotyledon, immature zygotic embryos, apical and nodal bud explants, and rooting performed on a medium added with endosperm extract. Addition of methyl jasmonate repressed cell growth and induced browning, with damage to G. When cultures are treated with a combination of methyl jasmonate and salicylic acid, further enhancement of the yield of the compounds occurred; the addition of precursors increased cell growth without any effect on the elicitation of triterpene lactones, but their ratio is modified. Post-thaw regrowth of calli is occasional, regardless of sugar concentration in the medium, while pretreatment with ABA and sucrose ensured stable regrowth after cryopreservation, and are associated with changes in content and composition of endogenous soluble sugars in the calli. Application of biotechnology through tissue culture and genetic engineering are choice approaches for conservation of the species and to meet industrial raw material demands for production of ginkgo herbal supplements. The low yield of ginkgolides and bilobalides and the slow growth of the tree along with low yield of the compounds in undifferentiated tissue are impediments to the supply of the compounds, especially the ginkgolide B that shows promise as highly antagonist against platelet-activating factor, which is involved in the development of many respiratory, cardiovascular, renal, and central nervous system disorders. In order to overcome existing shortcomings, the selection of high-yield genotypes, optimization of culture conditions through culture medium selection, elicitation, permeabilization, and precursor feeding will be promising. Considering the recent increase in knowledge about the metabolism and regulation of key enzymes involved in the biosynthesis of the compounds, the development of transgenic ginkgo with enhanced production of those metabolites is a serious possibility. Phytochemical and population

genetic studies are unraveling many threads of information regarding the medicinal importance and phytogeographic history of G. At present, no wild population of the species is in existence, and a program for the transfer of cultivated trees to the wild is yet to be established, but at the local levels the tree is conserved through plantation for ornamental and for religious or spiritual purposes. It is hoped that in the future, conservation measures to restore the population of G. Special appreciation is owed to Hamdard University New Delhi for providing research facilities.

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Chapter 4 : Ginkgo biloba - Wikipedia

4 cultivation of ginkgo biloba on a large scale. 6 ginkgo bilobalarge scale extraction and processing. 7 chemical constituents of ginkgo biloba.

This blog on Texas education contains posts on accountability, testing, college readiness, dropouts, bilingual education, immigration, school finance, race, class, and gender issues with additional focus at the national level. It is my privilege this time of the year to present the work of my undergraduate students at the University of Washington. This year I am presenting a series of outstanding blogs by students enrolled in my course on Environmental Anthropology. The large lecture format course introduces students to the field of environmental anthropology, which includes the study of Ethnoecology â€" the knowledge of ecology developed by indigenous and other traditional place-based peoples. The course also examines contributions from the fields of critical political ecology, which focuses on the role of science in the politics of environmental law, policy, and social movements. Finally, we study aspects of environmental history, which focuses on the role of human societies â€" both small- and large-scale â€" in processes of ecological change and includes analysis of the history of ideas about the quality of the human-environment relationship. Like the class, these blogs seek to bridge all these approaches and more by providing entries that address local place-based knowledge and situate Ethnoecology within the context of politics and history. The students illustrate the value of collective work and the possibilities that unfold with collaborative group projects as part of a critical pedagogy that challenges the hyper-individualism of our mass society. I also acknowledge the incredible contributions by my two graduate assistants, Claudia Serrato and Gabe Valle. They supervised the entire process of research, preparation, and editing of these blog entries. The results of their professional guidance and dedicated support of my students are superb. I am blessed to have such high quality graduate students in my midst. I am also grateful to Erik Jaccard, who serves as our English-writing instructor, and was masterful and skilled in preparing these entries for publication. The second entry in this series is about a tree, the Gingko Biloba, which is an organism that has survived on and adapted to changes in our planet for hundreds of millions of years. Reading this entry, you will learn that Buddhist and Taoist monks venerate the Gingko for its long lifespan approximately 2 to 4 thousand years , representing a strong, holy, and enduring life. The tree is a source of food and medicine and is also appreciated for spiritual and aesthetic values. The entry also explores the contemporary political ecology of the tree and the decline of biodiversity of the Gingko in part promoted by the nature of efforts to exploit it commercially in plantation monoculture tree farms and even conservation programs. This is a very well written and conceived, and very touching piece, as well: This extract is already being used, mostly in the form of herbal pills, to treat cardiovascular conditions, lung complications, and cognitive or memory disorders. It is used in these ways due to its anti-inflammatory properties, first discovered in ancient China. While the historical medicinal uses are vast, modern medical science is discovering more uses of this versatile plant every year. Use became more widespread and written records show that it was used as a food source since at least BCE and the Chinese soon came to honor and be proud of the tree. Moreover, our early ancestors recognized its sacred, medicinal, and practical properties. Thanks so much for sharing, Devon. I hope this piece gets the attention it deserves. We choose the Ginkgo because of its prehistoric roots spanning nearly million years as well as a deep history relating to humans. We will see how the traditional environmental knowledge of indigenous people that came into contact with the plant can create a better understanding of our surroundings. A deep history Fossilized leaf of an ancient Gingko In the Jurassic Period, the Ginkgoales thrived with over 20 species. Existing all over the world, fossil records show that the tree was most diverse in North America, East Asia and Europe, and it was nonexistent in the equatorial regions. Some scientists think that the dinosaurs helped spread its seed and consequently helped it flourish during this time. Parallel in the geological timeline, as dinosaurs saw their collapse by the Tertiary Period, the Ginkgo Biloba remained the only Ginkgo left. There were likely other contributing factors to the

downfall of the Biloba that occurred over the millions of years, like the great warming period that helped extinguish the dinosaurs, and subsequent ice ages, making it a living fossil. The Ginkgo Biloba is now the only living remnant of this family. Since the only native Ginkgo trees that survived the extinction were confined to what is now China, when people arrived in Southeast Asia, they grew to appreciate and cultivate the plant. The Ginkgo nuts are first mentioned in Japanese textbooks in for its uses: The Biloba was cultivated in the Southeast region of Asia exclusively until Joseph Kaempfer brought it from Japan to the Botanic Garden of Utrecht, Holland, in , and then, in , William Hamilton brought it to the last major continent in his estate in North America from England. From the time that the Ginkgo reached the European continent, it was used as an exotic ornamental tree for gardens, yards and public areas alike. As its presence in the Western world increased, so did its popularity among gardeners and landscapers. Dreamstime The Ginkgo tree, both its leaves and its seeds, have been used by humans for medicine, food and art for thousands of years. Historically, we have seen the resilience of the tree through such events as the ice age and even an atomic bomb at Hiroshima, making it a reliable source for use by people. The first recorded use of the leaves is from China in externally to treat skin sores and again in internally to treat diarrhea. Nearly all of the ethnobotanical uses of this plant originated from China or Japan, but today are common all throughout the world, including most European countries and America. This is seen in the shape of the leaf which is split in the middle, creating two lobes. Botanist Richard Salisbury is recognized for two names of the tree: The Ginkgo Biloba is classified in its own taxonomy group because of its rare seed formation. Therefore, the classification is as follows: Another factor that separates the Ginkgo seeds from common tree seeds is the fact that they are not protected by an ovary wall and can morphologically be considered a gymnosperm. Because of this, the Ginkgo has been placed loosely in the divisions Spermatophyta and Pinophyta but no consensus has been reached. For more than 50 years, horticulturists in parks and public places, commercial landscapes, and street tree plantings have made use of Ginkgo. It is estimated that there are over pharmaceutical and clinical studies in Europe have researched or are researching the medicinal uses of Ginkgo leaf extract EGb Nutritional supplements are an example of the commercialization of the Gingko Biloba The seed of the female Gingko tree, although less common than the male due to the odor it produces, can be used for food products, both ceremonially in indigenous cultures and for proclaimed health benefits predominantly in western society. It can also be used in Ginkgo tea, which some people claim brings longevity and generally better health. A sales report shows that Ginkgo-based health food products had sales upward of million dollars in the United States. In addition to medicinal and food-based uses for the Ginkgo tree, the plant has also been used as an art motif and as a medium for art historically. In China and Japan especially, the Ginkgo leaf is an esteemed motif used for family crests, kimonos, jewelry and paintings or drawings. Washington State Parks The petrified gingko forest in Vantage, Washington displays the fossilized wood of the tree as a medium for ancient petroglyphs preserved by the visiting center. They also host an indoor exhibit that displays small and medium pieces of petrified Ginkgo wood that resemble images of people, animals or objects as well as historical and regional information about the trees. The continued artistic and cultural use of the Ginkgo tree speaks to how appreciated it is by humans historically and today. As they learn to acknowledge the interest and significance of the oldest living tree, people will work to preserve the rare species. In the s, farming of the Ginkgo Biloba began to develop in China through a joint venture program in which thousands of small scale farmers harvest the leaves. There are also Ginkgo Biloba plantations in the United States and France, created by pharmaceutical companies who require large amounts of the leaves for their health food products and medicine. Farming of the Ginkgo Biloba, both small and large scale, has provided one sustainable method by which humans are currently fostering the species. In addition to the farming of the tree, it is also being sustained through its increasing popularity in landscaping. The use of Ginkgo trees in landscaping can be noted on and surrounding the University of Washington campus as well. There are multiple trees thriving on the campus, lining University Way and scattered throughout University District and the Ravenna and Montlake neighborhoods. These trees are found in every city in the United States, and whether it is in a

backyard, lining a city street or planted in masses, human use of the tree is undoubtedly aiding its recovery. The recovery of the tree has even been included in policy-making across country, including Seattle. As Ginkgo trees are extremely slow growing, this tree could be hundreds of years old at that size. Saving this tree means that not only will its beauty be recognized for generations, but the resilience of the tree as well. Seattle has been working for decades to become a more eco-friendly city and these tree regulations are one successful step in the process. The Ginkgo tree is a broadleaf, deciduous, and dioecious tree. By being dioecious, this means that it reproduces by the pollination of the female tree by means of the male tree. In order for a new tree to grow, the male and female trees need to be close enough for pollination to occur. The female trees produce a flower and fruit but it can take up to 20 years for them to be seen. When the fruit is dropped it produces a foul odor. This odor is described as rotting garbage, spoiled milk, and the likes. Due to the malodorous stench, most people are partial to the male tree, which does not produce fruit or flowers. When planting the Ginkgo tree, most opt for the male. The female tree is becoming less and less common. Because the male tree is seen by many landscape professionals and arborists as much more favorable, there has been a great loss in biodiversity. Old, native, original species of the tree are especially rare. Prehistoric Ginkgo trees have been found in Washington. The construction of a highway in Central Washington led a local geologist to discover an area with several different types of trees, including the Ginkgo. Although there are only a handful of Ginkgo trees in this park, it was so named because of the rarity of the tree. As we have seen, the Ginkgo tree has been used for medicine and decoration for thousands of years. With this long tradition comes the ability to grow the plant and ultimately cultivate it, known as agroecology. The Ginkgo is suited to moist, deep, and well-drained soils because the roots are more widespread, but it survives in a variety of soil pH levels, climates, with heat and cold. Planters usually fertilize the tree one to two times a year. The plant can also survive pest, fungus, viral, bacterial threats, ozone and sulfur pollution, fire, storms, ice-storms, and in one instance an atomic bomb. Typically, it grows in lowland forest valley areas below the 6, foot altitude mark. Native growers would have to wait for the seasons to start growing the plant. This cold stratification, as it was called, meant going from cold to warm to let the seed know when to emerge. The germination would take place in sterile sand and they would have to fight off the mold that would attack the embryo before emerging. The Japanese have used the Ginkgo in their bonsai gardens. This art form grows miniature aesthetically-pleasing plants in containers. The grower creates the plant to his ideals, more or less adapting the plant to suit a certain type of beauty. Shape, size, and proportion are considered and now there are many varieties suited to growth height, color, leaf shape, and weather conditions. Most of the Ginkgo Bonsai trees were the males since they do not produce the odorous fruit that the female does. The Japanese also used traditional environmental knowledge to take the chichi nipples , which were the outer growths that eventually grew to the ground, and plot them upside down to make delicate leaves blossom from these little branches.

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Chapter 5 : Ginkgo Biloba - Google Books

Ginkgo biloba is famous for its powers of survival. On the evolutionary time scale, the genus can be traced back at least to the middle Jurassic, while species that are similar to G. biloba date.

See you there in !!! Conifers Diselma archeri A beautiful, medium sized to large bush of lax habit. Leaves scale-like, adpressed to and concealing the slender branchlets. A wide-spreading shrub or small tree growing 1. The leaves are scale-like,sometimes reddish at first,turning olive-green or green,mm long and 1. The seed-cones are globose,4x4mm. Fitzroya cupressoides Tree or large shrub having lux pendulous foliage. Given moist and sheltered conditions it can grow very large. Oldest and largest tree in Chile. Grows on poorly drained wet soil. Ginkgo biloba Maidenhair Tree Unique species of tree, with no living relatives. Various uses in tradional medicine as food. Large trees reaching 20 - 35 metres in height. A broadly conical male form with excellent golden yellow autumn colour. A male,broadly conical,symmetrical,tree with especially bright golden yellow autumn colour. In ten years 3x1m or more. Very dwarf and slow growing. Ideal for bonsai, containers and small spaces. Its fan-shaped green foliage turns bright yellow in autumn before it is shed, creating a pool of colour on the floor of the garden bed or patio. Its unique fan-shaped leaves provide excellent autumn colour. Can reach a height of around 10m. Makes a lovely feature specimen. Ginkgo biloba Fastigiata Narrow growing columnar form of this lovely tree. A columnar form with semi-errect branches. A large-growing,male,conical to columnar,fastigiate tree. In ten years 8x1. Reported from RBG Kew in but probably no longe identifiable. Ginkgo biloba Mekkens Minuet Small tree in all attributes compared to the species. Much smaller foliage and a neat pyramidal habit. Typical bright gold autumn tones. Australian selection by michael mekken. Ginkgo biloba Pendula A remarkable form with spreading or weeping branches. A slow-growing tree with a broad umbrella-shaped crown and pendulous spreading branches. In cultivation in Belgium since More then one clone seems to be in cultivation, some more genuinely pendulous than others. Ginkgo biloba Queen of Fruits female Page 9 of

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Chapter 6 : Rethinking Ginkgo biloba L.: Medicinal uses and conservation Isah T - Phcog Rev

Cultivation of Ginkgo biloba on a Large Scale / Dominique Laurain Plant Cell Biotechnology of Ginkgo / Danielle Julie Carrier and Dominique Laurain -- 6. Ginkgo biloba -- Large Scale Extraction and Processing / Joe O'Reilly -- 7.

This article has been cited by other articles in PMC. Abstract Ginkgo biloba G. Palaeobotanical history showed a wide distribution of the species across the globe but declined over geological time, becoming restricted to narrow geographical range with few surviving individuals in the modern day. The tree is slow growing, adapted to many ecological conditions and shows numerous adaptation in developmental patterns. Medicinal use of the species is attracting research interest, especially the various parts of the tree that are used in orthodox or traditional medicine to treat diseases due to the many bioactive compounds. The primary compounds receiving increasing research interest are the triterpene lactones and flavonoids; these are the target of biotechnological strategies being employed to enhance production. Many genetic and environmental factors have contributed to the endangered status of the species; conservation measures are required to protect it from extinction. In many countries, the cultivation of plantations for the supply of ginkgo leaf-based pharmaceutical formulations is in progress, and efforts to standardize ginkgo leaf extract as herbal medication for human use are being made. Microcuttings and cuttings, cryopreservation, and plant tissue culture have all aided to conserve G. Its relationship with other plants is uncertain. As a result, it is classified in its own division: Ginkgophyta, having the extant species G. The plant shows high resistance to environmental stresses, microbial diseases fungal, viral, and bacterial , other pests, and gaseous pollutants ozone and SO2, making it suitable and relevant for planting in urban areas. Indeed, it can act as a model to study disease resistance and stress in plants. The ginkgo has tremendous medicinal, spiritual, and horticultural importance in Chinese culture. The supplements are bestselling herbal medications with a long history of use in traditional medicine to treat blood disorders; these are known to improve memory and offer the best-known way to keep the mind sharp. Leaves and seeds of G. Modern research focuses on the standardization of G. The tree produces biflavones, constituents in its leaves: Ginkgo leaf extract is used in medicine due to its therapeutic actions in regulating cerebral blood flow, protection against free radicals, and delaying the progress of dementia and diabetes. The range declined until 2 million years ago, when the trees were restricted to a small area in China. The most plausible ancestral group of the order Ginkgoales is Peltaspermales, while the closest living relatives of the clade are cycads that share the characteristics of motile sperm with the extant G. Evidence indicates that the decline was due to decreased temperatures. The vigorous young ginkgo tree is pyramidal with a principal central leader and wide-spaced whorls of lateral branches that grow out at a diagonal orientation to the trunk; increase in height slows at maturity when the tree fills out the sparse, branched juvenile structures in a spreading crown formation. The leaves are deciduous, petiolate, fan-shaped, bilobed, thickened at the margin, broader than they are long, dichotomous-veined, and arranged in an alternate or clustered fashion of on the short shoots. The catkins of males emerge before the leaves fall off and after pollen is shed, and pollination is facilitated by the wind, while the ovules of females are produced in pairs and borne at the ends of stalks mm long. Once inside, a male gametophyte undergoes 4 months of development that result in the production of a pair of multiflagellated spermatozoids. One of the spermatozoids fertilizes the egg cell while the ovule remains on the tree. Embryo maturation completes in weeks after seeds fall, and the foul odor from the fruits indicates that they are mature. The behavior of G. The therapeutic effect and pharmacological action are due to the joint effect of multiple components, and no individual component is regarded to solely exert the effect.

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Chapter 7 : The Requirements to Grow Ginkgo | Home Guides | SF Gate

Ginkgo biloba, commonly known as ginkgo or gingko (both pronounced / Ëˆ É¡ Éª Å˂ k oÊŠ /), also known as the maidenhair tree, is the only living species in the division Ginkgophyta, all others being extinct.

Fossil records show the ginkgo tree was widespread more than million years ago, although in recent centuries it nearly became extinct. Gingko grows hardy to U. Department of Agriculture zone 4. The tree grows slowly but eventually reaches up to feet. Proper site selection and care allows you to grow and enjoy this tree for years. Propagation Options Ginkgo biloba comes in many varieties, but in general, avoid growing female trees. Female ginkgo trees bear round fruits that have a smell akin to vomit or rotting food. If growing from seed, fill a plastic bag with damp peat moss. Bury five ginkgo seeds within the moss and seal the bag. Check for germination periodically; sprouting begins in two to three weeks. Most gardeners prefer to propagate ginkgo from softwood cuttings taken from male trees. Site Selection Ginkgo trees are tolerant of pollution, making them an ideal choice for urban locations. Before planting a ginkgo tree, consider its estimated height and canopy width at maturity. When mature, ginkgo trees reach up to feet tall and have a canopy between 30 and 50 feet wide. Avoid planting the ginkgo tree under or close to power lines or other tall structures. Soil, Light and Water Ginkgo biloba trees require well-draining soil to thrive. They grow in heavy clay, loam or light, sandy soil, but of all these soil types, sandy soil is best for the ginkgo tree. When you dig a hole for your ginkgo tree, fill the bottom with a 2-inch layer of compost. Ginkgo does not need additional fertilizer to thrive. Ginkgo trees must receive full sun; they grow poorly in the shade. Keep the soil moist during its first three to five years. The ginkgo tree is drought tolerant after that time. Growing in Containers Container-grown ginkgo has many of the same needs as ginkgo grown in the ground, although some of its requirements differ. Choose a container with ample drainage holes. Ginkgo kept in a container needs regular watering, especially when actively growing. Water your ginkgo tree when the soil feels dry. Prune the ginkgo in winter, if desired.

Chapter 8 : Ginkgo Biloba - Google Libri

Ginkgo biloba (G. biloba) is an ancient medicinal tree species that has been in existence for millennia without undergoing modifications due to its resistance to environmental stresses.

Chapter 9 : Ginkgo biloba: a natural reducing agent for the synthesis of cytocompatible graphene

Propagation Through Rooting of Stem Cuttings of Ginkgo for large-scale propagation and plantation for its Ginkgo biloba has been reported by Dirr et al.