

LESSON 9

Medicinal Mushrooms



Mushrooms have always held a great fascination for man, from the vision-producing mushrooms the shamans used in their initiation rites to the mushroom hunters of northern Europe. Many fairy tales include members of the Fungi Kingdom as part of the backdrop. Yes, mushrooms are members of the Fungi Kingdom. People often shudder when they hear the word ‘fungi’. It conjures up images of some life form taking over a university student’s refrigerator, or dirty showers, or maybe even a yeast infection. There are more than 140,000 different species of fungi, some are beneficial to man, some not. Some are edible, some poisonous, some produce visions, and some have strong medicinal properties. In Asia the recorded use of medicinal mushrooms stretches back more than 3,000 years, during which time mushrooms continuously maintained a prominent spot in their medical systems.¹ In western society medicinal mushrooms have played varying roles. We do find references dating back as far as Hippocrates (455 B.C.). Fungi are also mentioned in the works of Pliny (23-78 AD), Dioscorides (55 AD) and Galen (130 - 200 AD), proving that the ancients were quite familiar with their uses. Between then and the discovery of penicillin (another fungus) in 1928, we find scarce evidence of medicinal use. Today, however, medicinal mushrooms play a more prominent role, making up a whole class of antibiotic medicines.



Medicinal Mushrooms have a very long history of use in Asia, Europe and Russia, but have only become an important category of Natural Medicine in North America over the last decade or so. Worldwide we can see that this area is one of the fastest growing categories, with 1.2 million tons of medicinal mushrooms produced in 1981, 7 million tons in 1999 and 9.9 million tons in 2004. However the U.S. market is only a small fraction of this volume.² There have been several journals, books and reviews written over the last decade in the N.A.



What are “Mushrooms”?

‘Mushroom’ is not a taxonomical category, but a commonly used name. The definition of mushroom is: ‘a macrofungus with a distinctive fruiting body, which can be either hypogeous (below ground) or epigeous (above ground), large enough to be seen with the naked eye and to be picked by hand.’³

Taxonomically mushrooms are mainly basidiomycetes with several species of ascomycetes. Mushrooms are neither plants nor animals, but are in a separate Fungi Kingdom. There are 14 – 22,000 known species of mushrooms, with an estimated 140,000 occurring species worldwide. This shows that there is potentially a very large untapped resource, with an estimated 7,000 species that have benefit to mankind.⁴ Even among the known species there are a very small number of thoroughly investigated mushrooms. The fact that there is a large amount of documented enthomedicinal uses and strong bioactivity of researched species, gives us the impression that we should expect many more natural medicinal substances from this area in the future.

It shouldn’t be surprising that some mushrooms have strong medicinal properties, when you consider their basic role as that of transmuting waste material into good, nutritious material. They are considered panacea, making them seem somewhat magical. Claims that medicinal mushrooms are tonic and energy enhancing, with beneficial effects on the immune, respiratory, circulatory, endocrine, nervous, digestive and skeletal/muscular systems makes one wonder if their uses are a little overstated. The fact that they are used to reduce tumors, blood cholesterol, blood pressure, bronchial inflammation, nervous tension, viral infection, insomnia, duodenal ulcers, allergies, diabetes, hepatitis, progressive muscular dystrophy and high-altitude sickness makes one wonder how they work. They are also being used to reduce symptoms of AIDS, Chronic Fatigue Syndrome, Fibromyalgia, Asthma, Cancer and the side effects of chemotherapy. At the same time these wondrous medicinal mushrooms are used to enhance overall energy, athletic feats, intellectual challenges, environmental stresses and are considered to be longevity herbs.^{5, 6}

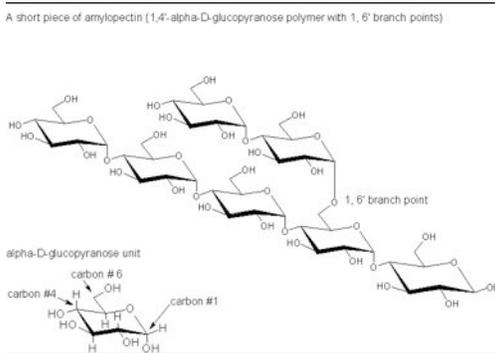
What makes them tick? Is there any truth to their almost mythical power to transmute toxic waste material and negative



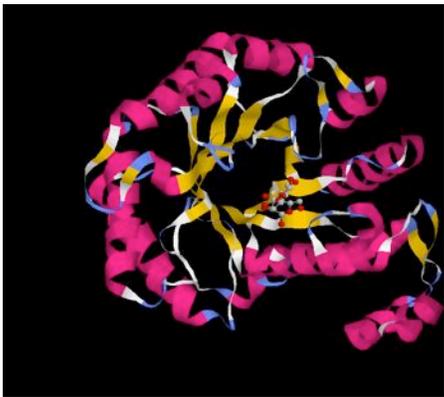
emotions into positive and clean ones? We can gain some insight by looking at the mushrooms' biochemistry.

Major mechanisms of Medicinal Mushrooms

There are several constituents of interest in medicinal mushrooms, with approximately 400 substance isolated from *Ganoderma* (Reishi) alone. The most studied constituents are polysaccharides, triterpenoids, nucleosides, ergosterol, fatty acids, protein/peptides and trace elements. And of these the most studied are various branched polysaccharides and triterpenoids. Most likely because of the large array of activity found from a variety of constituents, many health care practitioners consider medicinal mushroom, multiple-medicinal supplements, akin to multiple vitamins and minerals.

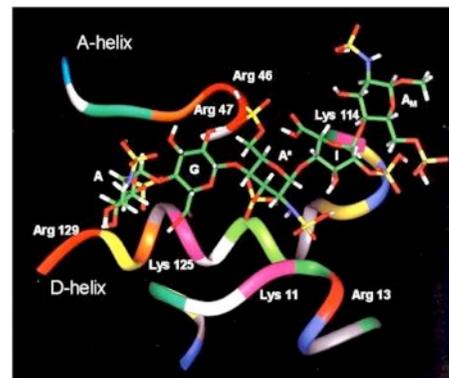


Polysaccharides (in particular β -D-glucans) and polysaccharide-protein-complexes have immunomodulating effects on the body. Not new to the realms of natural healing, polysaccharides have been shown to stimulate non-specific immune system function as well as exert antitumor activity through the stimulation of the host's defense mechanism.^{7,8,9} These beta-glucans have been termed "biological response modifiers", due to the large array of functions attributed to them. Even though the mechanism behind the various polysaccharides is only partially worked out, there have been many theories with no complete consensus.



Polysaccharide- protein complex

Both clinical and animal studies have shown that the beta-glucans can activate certain aspects of the immune system. Research has shown that the beta-glucans found in medicinal mushrooms have the ability to stimulate macrophages,¹⁰ NK cells,¹¹ T cells,¹² and the production of immune system cytokines. In addition, studies suggest that mushroom polysaccharides may also be able to increase dendritic cell function.¹³ There is evidence that beta-glucans function by binding to membrane complement receptor type 3 (CR3, alpha M β 2 integrin or CD11b/CD18) on immune effector cells. The intercellular events that occur after glucan-receptor binds, has not been fully worked out. The shape, size, degree of branching and association with protein or peptide groups significantly affect the biological activity observed.



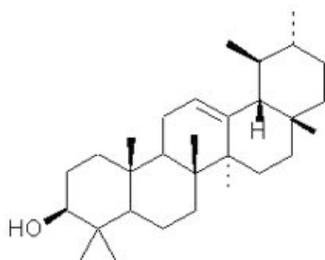
A section of a polysaccharide-protein complex

Much of the theoretical research is done in vitro, with no clear understanding of how these extremely large molecules



absorb into the bloodstream and arrive at the receptor sites. The concept of pinocytosis, or 'cell-drinking' has been suggested as a mechanism of absorption that leaves whole or partial molecules intact.

Some subscribe to an alternative theory of signals being generated by the various polysaccharides and protein complexes from their location in the intestinal tract. It is thought that these signals are what really activate the receptor sites in the immune system. This signal could be similar to a radio wave, but is mostly likely photon based, as it appears to stimulate general coherences in the immune system, rather than stimulating or sedating it.



Triterpenoids contain a lanostane skeleton often with steroidal-like shapes. The smaller molecular weights have shown biological activity such as: antitumor, immunomodulating, hepatoprotective, antiviral and antioxidant effects.¹⁴ There are many varieties of triterpenoids, with Reishi having over 120 in it alone.^{15,16}

Actions for Several Medicinal Mushrooms

Since there are common actions for several of the mushrooms, I will list some of them briefly below. I have listed only a small portion of the research, as the field is very large and similar activities can be seen in multiple mushrooms.

Antioxidant activity: Many of the medicinal mushrooms contain antioxidants such as ascorbic acid, carotenoids, ergothioneine, phenolic compound, superoxide dismutases (SOD), and tocopherols.¹⁷ Medicinal mushrooms with antioxidant effects include: *Agaricus blazei*,¹⁸ Chaga^{19, 20, 21} *Flammulina velutipes*,²² Maitake,²³ Reishi,^{24, 25} and Shiitake.^{26, 27}

Antibacterial and Antifungal Mushrooms: Due to the natural environment of most mushrooms, it is not surprising that they have strong activity against bacteria and fungi. It is interesting that only compounds from microscopic fungi have been marketed as antibiotic, when there is a large array of compounds from most medicinal mushrooms. Several constituents have shown broad-spectrum use. Some, including sesquiterpenoid hydroquinones from *Ganoderma sp.* have



shown activity against multi-resistant bacterial strains such as methicillin-resistant *Stap. aureus*^{28,29,30} Oxalic acid as found in Shitake, as well as ethanolic mycelial extract have shown antimicrobial action.^{31,32} A review summary of Aphylophorales can be found by Zjawiony.³³

Antiviral Mushrooms: In contrast to bacterial and fungal infection, allopathic medicine has very little to resist viral infections. There is great promise from both whole extracts of mushrooms, as well as from isolated compounds. This can be observed with direct contact to the viruses and indirect antiviral effect resulting from immunological activity of the polysaccharides and other compounds.³⁴ Several triterpenes of Reishi and water extract of Chaga have activity against HIV-1.^{35,36} Extract of Chaga has shown antiviral action against Influenza A and B,³⁷ Ergosterol found in several mushrooms also has an antiviral action.³⁸ Many other mushrooms including water extract Shitake mycelium and protein-bound polysaccharides (PSK and PSP) from Coriolus and D-fraction from Maitake have shown multiple antiviral function.^{39,40,41,42,43,44}

Antitumor Mushrooms: Some of the mushrooms have long term folklore associated with their use on cancer including Chaga that was used in the 16th and 17th century in Eastern Europe to treat cancer⁴⁵ and Reishi (Ling Zhi) in China over 2000 years ago. Several extracts of whole mushrooms, as well as isolated compounds including triterpenes, ergosterol and polysaccharides have shown well documented antitumor action. Most of the medicinal mushrooms reviewed here have shown various actions in this area.

Immunosuppressive and Antiallergic: Even though we have seen that several of the mushrooms can stimulate the immune system, some can suppress immune function when required. Interestingly sometimes both stimulatory and sedative functions can be found in the same mushroom. Reishi has been shown to inhibit histamine release.^{46,47} Isolates of Chaga including ergosterol, hispolon and hispidin, some found in many mushroom have antiallergic action.^{48,49}

Antiatherogenic Mushrooms: Several of the mushrooms have strong action of regulating cholesterol. Reishi^{50,51} and *Agaricus blazei*^{52,53} have shown to have an inhibitory effect



of cholesterol levels. Shiitake mushroom contains an anti-cholesterol compound called eritadenin.⁵⁴ Oyster mushroom has a naturally occur statin drug known as lovastatin (brand name: Mevacor, Altoprev)⁵⁵ Many studies have shown that consumption of several of these mushrooms can control cholesterol.^{56,57}

Hypoglycemic Mushrooms: With the increase of both type 1 and type 2 diabetes around the world more effective treatments are needed. Several medicinal mushrooms can lower elevated blood sugars. Polysaccharide from Maitake^{58,59,60} Ganoderan A and B from Reishi,^{61,62,63} glucan-protein complex from Coriolus⁶⁴, as well as whole extract and constituents from Chaga⁶⁵, Agaricus blazei^{66,67,68} and Cordyceps^{69,70,71} all have blood sugar regulating effects. The mechanism has not been worked out for most mushrooms, but Maitake action has been shown to be an alpha-glucosidase inhibitor.⁷²

Anti-inflammatory Mushrooms: Several ganoderic acids from Reishi have been shown to have stronger anti-inflammatory action than acetylsalicylic acid.⁷³ Ergosterol found in many of the mushrooms has been shown to inhibit COX (cyclooxygenases 1 and 2) activity.⁷⁴

Hepatoprotective Mushrooms: Ganoderic acids, some glucans and other compounds from Reishi have shown liver protection both in vitro and vivo,^{75,76,77} Reishi has also been shown to have activity against Hepatitis B.⁷⁸ Other mushrooms, especially Coriolus, have shown strong protective action for the liver.

Mushrooms with Central Activity: Lion's Mane has shown possible anti-dementia activity, while demonstrating ability to stimulate nerve cell growth.^{79,80,81} Lion's Mane has also shown ability to stimulate myelination.⁸² Several mushrooms have been studied for functional pain reliever with opiod like action.^{83,84,85,86}

Vitamin D₂: Even though it has been shown you need 2 and 3 times as much Vitamin D₂ as Vitamin D₃, mushrooms are the only non-animal source of Vitamin D. When exposed to UV light, mushrooms have been shown to convert ergosterol into vitamin D₂. The amount of Vitamin D found in these



mushrooms is high enough to support vegans through the winter months. High Vitamin D₂ mushrooms are now available in United States, but shelf life studies and more research is still needed in this area.^{87,88,89}

The following is a chart comparing the various therapeutic effects of the different fungi:⁹⁰

Therapeutic Effects	Reishi	Cordyceps	Miatake	Shiitake	Poria cocas	Coriolus	Polyporus	Agaricus	Chaga
Anti - bacteria	X	X	X	X	X	X	X		X
Anti-Candida	X		X	X	X				X
Anti-inflammatory	X				X				X
Antioxidant	X	X				X			X
Anti-Tumor	X	X	X	X		X		X	X
Anti-Viral	X	X	X	X		X	X	X	X
Blood Pressure	X	X	X	X	X		X		
Blood Sugar	X	X	X	X				X	X
Cardio-vascular	X	X					X		X
Cholesterol reducing	X	X	X	X	X		X	X	
Immune enhancing	X	X	X	X	X	X		X	X
Kidney tonic	X	X		X		X			
Liver tonic	X	X		X		X			X
Lung/ Respiratory	X	X	X						X
Nerve tonic	X	X			X		X		X
Sexual potentiator		X		X					
Stress reducing	X	X	X	X	X				X



As you can see from both folklore and scientific information, medicinal mushrooms can play an important role in almost anyone's health program. Even though it is true that mushrooms should not be consumed by people with Candida Yeast infections, most medicinal mushrooms are safe for these people and they can often reduce symptoms and underlying causes of the candida problem.

Medicinal mushrooms come in many forms. The three most frequently found forms in the health food market are: fruiting bodies, mycelium, solid extracts. Some times these are combined. The fruiting body is what we normally think of, when we think of a mushroom. It is like the fruit on a tree; say an apple or an orange. The tree is the mycelium. The mycelium is a very large, complex netted growth forms and the major body of the fungi. They live in the soil, tree or what ever the substrate of the fungi is. The mycelium is often only a few cells thick and is often the most medicinal part of the fungi. It is certainly the most bio-available part of the fungi, especially for the 'hard polypore mushrooms. Extracts are usually made as concentrates of either the mycelium or the fruiting body, enhancing medicinal quality. If using the fruiting body, thorough cooking is needed. Raw fruiting bodies are mostly non-active due to the protient/polysaccharide matrixes.

Fungi are quite easy to clone, from tissue culture, so often you will find very specific strains. Because fungi produce fruiting bodies in the form of mushrooms, it is very tempting to consider them plant, as did the scientific community until recently. Fungi are in their own kingdom. We have Plant, Animal and Fungi kingdoms. In fact many of the medicinal mushroom we will be discussing are closer to animal than plants.⁴ They indeed 'breath' in oxygen and 'breath out' carbon dioxide. The higher fungi, like the mushrooms produce chemicals (enzymes, hormones antibiotics etc.) closer to humans chemistry than most plants do.

The mycelium network have been shown to have an intelligence. Many theorist have used analogies of these



mycelium mass being the planet's (Gaii's) own internet net service, predating our attempt at it by many billions of years.

There are many stories surrounding medicinal mushrooms. My favorite has to be the one I heard from one of my teachers, an Amazon Shaman. In trying to understand more about the personality of a medicinal mushroom, I asked him to explain his use of Reishi (*G. lucidum*). He told me that the part we call 'mushroom' and use is just the fruit. The actual plant lives underground, often covering several acres and even up to a couple miles underneath the Amazon jungle. He explained that these fungi are very old beings, living in the earth and drawing on its (Gaia) energy for thousands of years. The result is a calming, wise energy -- an energy that we might consider a sage may possess. By using the fruit as medicines, we take on some of the calming wise energy, helping to ground us - something many people in western society could really use.

Summary

As can be seen there has been a lot of research done in the area of medicinal mushrooms, but the surface has barely been scratched. We can find many fungi with strong therapeutic uses. The bioactivity can often be found in the polysaccharide and the triterpenes, but many other mechanisms can also be found. Some of the various mushrooms have activity in many areas and thus have been used by health care practitioners as multi-medicinal substances. There needs to be much more research in this area, with strong incentives for pharmaceutical prospecting.

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***Ganoderma lucidum* - REISHI Family - Basidiomycetes**

Common names: *G. applanatum* and related species, *Ling zhi*, *G. tsugae*, Lingzhi 灵芝, 영지

Plant description: This wood-decomposing fungi has a circular kidney-shaped cap divided by concentric growth rings, resembling a ram's horn. The color is shiny, lacquered red to reddish-brown. The fruiting body is very woody, as is the stem. The spores are white to brown with age, but the spore print is brown.



Habitat, ecology and distribution: Reishi is usually found on rotting hardwood logs that are quite rare. Artificial culture and cultivation of *G. lucidum* fungus were attempted initially by T. Henmi et al., in 1937. Its mass production was first achieved by Y. Naoi in 1971 by cultivating the spawn using pots containing sawdust. Since then use of bed logs or sawdust has become established practice. For some purposes a bagasse spawn bed method and bottle or bag cultivation may be used. Usually, for mass cultivation of high quality Reishi, either out doors, bed logs of white oak, oak, Japanese chest-nut, Japanese apricot, etc., are used.¹ The use of organic gains, especially millet, has become very popular for the North American Health food market.

The 1995 production of Reishi in Japan was estimated to be about 500 tones dry weight. Reishi cultivation has also prospered in China, Taiwan, Korea, Thailand, and Vietnam. In addition, attempts are being made to obtain useful cellular materials or to produce effective substances from cultured mycelia.

Part used: Fruiting body, mycelium (biomass).

History: Reishi mushroom (known in China as *ling zhi*) has been considered the most valuable herb of the Orient, outpacing even the reputation of ginseng. The mystical qualities attributed to this herb might be explained by the rarity of this plant. Only 2 - 3 mushrooms are found for every 10,000 dead plum or hemlock logs. Sophisticated cultivation techniques now make Reishi more available.

The nature of reishi mushroom is documented in *Shen nung tsao ching* (56 B.C.). It is described as having the most extensive and effective healing powers. Since that time it has been considered number one amongst the higher herbs. Over the centuries it has gone by many names: Happy herb, herb of spiritual potency, Ten-thousand-year mushroom, Miraculous chi, Auspicious herb and Good omen plant. Folklore has it that the herb was considered so valuable that if a person found one they would not even tell their closest friends or relatives.



When one reads the list of ailments it is supposed to cure, there is an immediate impression of a "snake oil" product. A cure-all! It is tempting to consider the stories about Reishi as wives' tales along with lore such as: "the gods planting it in the mountain, for only the special to find". On the other hand, Nissan (one of the three largest conglomerates in Japan) has conducted extensive research on Reishi and is the major world supplier of the herb.

Cast in the terms of traditional Chinese medicine, it includes: nourishing, supplementing, toning, removing toxins, and dispersing accumulation. It is indicated for neurasthenia, nervousness, dizziness, insomnia, high blood pressure, high cholesterol, chronic hepatitis, cancer, AIDS, nephritis, bronchial asthma, allergies, pneumonia, stomach disease, coronary heart disease, diabetes, angina, mushroom poisoning, fatigue, and for enhancing longevity. Reishi is often classed as an adaptogen (a substance that aids the body in resistance against a wide range of physical, biological and environmental stresses). *Ganoderma lucidum* was praised for its effect of increasing memory and preventing forgetfulness in old age reported in Shen Nong Ben Cao Jing vol. 1 as early as 456-536 AD.

Constituents: There are many active ingredients found in this plant. The major groups are polysaccharides (gandelan A & B, and several glucans), lanostans, coumarin, ergosterol, triterpenes (ganoderic acids, ganodermediol), adenosine, uridine, uracil, small amounts of germanium, organic acids and resins.²

Medical Research:

Respiratory: it demonstrated a 60% recovery rate in allergy-related chronic bronchitis. In the same research, improvement was noted in 97.9% of the cases. Chinese studies have shown benefit for 87.5% of bronchial asthmatics with a cure rate of 48%. For sinus problems, the cure rate is over 50% with approximately 80% effectiveness. Reduction of asthma in guinea pigs, and contact dermatitis in mice, has been considered remarkable by Japanese researchers.³ Reishi was shown to significantly inhibit histamine release and to be effective against Ig-E related allergies.^{4,5}

Lipids: Reishi protected mice from the effects of accumulated fatty acid and cholesterol when taken along with a fatty diet.⁶ The herb also showed significant results in lowering blood lipids and fatty deposits in the liver. In a small study done on 10 cholesterol patients, significant drops in cholesterol and triglyceride levels were noted after two months of taking reishi mushrooms.⁷

Cardiovascular: Injection of the extract has lowered blood pressure in both dogs and rabbits, while increasing urine volume. In a study conducted on genetically hypertensive (high blood pressure) mice, blood pressure was lowered by 20% after consuming reishi for two weeks. Another study, involving 10 patients with high blood pressure, found a 70% improvement in blood pressure (especially diastolic) after removal of medication and use of reishi. A third study with 10 patients over 20 weeks produced significant improvement using reishi and pharmaceutical preparations compared with patients only using the pharmaceutical. In another study done on 53 patients, reishi was shown to



reduce blood pressure and blood lipid, with no side effects.^{8,9}

The active ingredient for circulation has been isolated. It is a triterpene which inhibits angiotensin converting enzyme (responsible for narrowing the arteries in high blood pressure).¹⁰ Reishi inhibits excessive platelet accumulation and reinforces the outer membrane of the red corpuscle.^{11,12} Reishi is known to stop thrombi formations (blood clots).¹³ In China it was shown to be effective in 80% of myocardial infarction and angina cases while being curative in 25%.¹⁴

Anti-microbial: This fungi has antibacterial effects on *Bacillus pneumonia*, staphylococci and streptococci bacteria. It can be used as an antidote in mushroom poisoning.¹⁵ It is antibacterial,^{16,17} anti-viral,^{18,19} anti-fungal,^{20,21} protease inhibitors and other anti-HIV substances have been found in *Ganoderma*.^{22,23,24}

Cancer: Studies completed in Japan have confirmed that Reishi can be responsible for arresting metastatic cancer in laboratory mice. The Japanese Cancer Society has found Reishi effective against sarcomas. The active ingredients responsible for this are the polysaccharides.²⁵ In clinical studies at Sloan-Kettering Cancer Center reported that applications of *Ganoderma* should be considered for (1) chemoprophylaxis of cancer in individuals at high risk for developing cancer (2) adjuvant use in the prevention of metastasis or recurrence of cancer (3) palliation of cancer related cachexia and pain and (4) adjunctive use with concurrent chemotherapy to reduce side-effects, maintain leukocyte counts and allow a more optimal dosing of chemo or radio therapeutics. Since studies of human dosage were traditional and empiric a dose range was calculated using this data and pharmacokinetic principals. The calculations suggested that a (1) *Ganoderma* dried fruit body dose of 0.5 to 1 g per day for health maintenance (2) 2 to 5 g per day if there is chronic fatigue, stress, auto immune, or other chronic health problems (3) 5 to 10 g per day for serious illness.^{26,27}

Ganoderma has had good success for ovarian cancer.²⁸ Preventing many forms of cancer from metastasis.²⁹ It has been shown to protect the body from radiation.³⁰

It has been reported that some triterpenoids (ganoderic acid -R, -T, -U, -V, -W, -X, -Y, and -Z) isolated from cultured mycelia of *G. lucidum*, Mannentake showed a cytotoxicity-based carcinostatic effect on hepatoma cells in vitro. Strong antitumor activities were found in various hetero-b -8-D-glycans having a b -8-(1-3)-D-glucan chain as the active site, such as b -D-glucan, glucurono-b -D-glucan, arabinoxylo-b -D-glucan, xylo-b -D-glucan, manno-b -D-glucan and xylomanno-b -D-glucan, as well as their protein complexes.³¹

Based on such indirect data, indications for *Ganoderma* use in cancer include supplementation a) to reduce side-effects during chemotherapy or radiotherapy, b) to prolonging survival and minimize metastasis, c) to improve quality of life, and d) to prevent occurrence or recurrence. In sum, although the cure of any cancer with *Ganoderma* alone is unlikely, it is probably beneficial under most cases of malignancy.^{32, 33,34,35}



Reishi mushroom extracts has inhibit proliferation of several cancer cell lines in vitro, including lymphocytic leukemia, lung carcinoma, human hepatoma, human breast cancer, human prostate cancer, human cervix uteri tumor, and bladder cancer. These extracts also seem to have direct cytotoxic activity against hepatoma, cervix uteri tumor, mouse and murine sarcoma, and human breast cancer cells.³⁶ As a supplement for cancer patients to improve quality of life. Significantly, Ganoderma supplementation was noted to decrease pain in cancer patients.³⁷

Immuno-modulating: There have been a wide range of studies done on both the polysaccharides and the triterpenes effect on the immune system.^{38,39} Functional in reducing many types of allergies,⁴⁰ as well as have significant antioxidant effects.⁴¹ Reishi mushroom extract can reduce peripheral blood mononuclear cell proliferation in vitro.⁴² The polysaccharides such as beta-glucan have antitumor activity.⁴³ They stimulate cytokine production from macrophages and T lymphocytes. The polysaccharides increase interleukin-1 (IL-1), IL-6, and tumor necrosis factor-alpha (TNF-alpha) in macrophage cultures. The polysaccharides also increase release of interferon-gamma from T-lymphocytes.⁴⁴

Triterpenoids from Ganoderma also have potential immunomodulating, antitumor, and antioxidant activities.⁴⁵ Gandelan A & B are the known factors responsible for Reishi's sugar-regulating ability. In the digestive tract, Reishi has shown an 80% cure rate for ulcers. Chronic hepatitis, a notoriously difficult viral infection, showed a 10% cure rate in 2 months with 40% reduction of symptoms. Reishi reduced the symptoms associated with hepatitis in carbon tetrachloride-induced hepatic as well as other liver issues^{46,47,48} The MEOH extract of the fruiting bodies was found to be moderately active against HIV-1 as well as its essential enzyme, protease (PR).⁴⁹

Liver: Polysaccharides from reishi mushroom also seem to stimulate glutathione S-transferase activity, suggesting that it could have a potential role in detoxification reactions.⁵⁰

Prostate: *Ganoderma* compounds inhibit 5-alpha reductase activity in the biosynthesis of dihydrotestosterone.⁵¹

Toxicity: The toxicity of this mushroom can be considered completely negligible with an LD₅₀ of > 5,000 mg/K. No toxic effect at this level was noted after 30 days of consumption. This suggests that no toxic signs would be found in humans if they consumed 350 grams a day, 40 - 300 times the therapeutic dose.

Herbal action: Adaptogen, nervine, relaxant, stimulant, anti-allergenic.

Indications: Insomnia, anxiety, heart palpitation, cancer, asthma, high blood pressure, high blood cholesterol, high blood triglyceride, circular thinking, longevity, immune modulator; allergies, heart tonic, liver protectant and tonic.



Contraindications and cautions: During the initial period of intake, some people have observed dizziness, sore bones, itchy skin, increased bowel movements, hardened feces, and/or pimple-like eruptions. These can be considered normal signs of the reishi excreting body toxins. These disturbances vary from person to person and will disappear as intake continues.

Medicinal uses: Reishi has been examined extensively through both traditional and modern scientific methods. A more detailed review can be found in my book, *Reishi Mushroom; Herb of Spiritual Potency and Medical Wonder*.⁵² Both the ethanol and aqueous extracts have been found to inhibit the central nervous systems of mice and act additionally as expectorants. It has been used for nervous problems like insomnia and paranoid conditions in humans.⁵³ Reishi can be considered an antioxidant with justification. It is very likely that this feature contributed to its reputation as a longevity herb in Chinese medicine. More recently, it has been shown to be effective in scavenging hydroxyl radicals in blood plasma.⁵⁴

The ancient Chinese text Shen Nong Ben Jing volume 1 from about the year 500 states that *Ganoderma lucidum* is useful for enhancing vital energy, increasing thinking faculty and preventing forgetfulness. It can refresh the body and mind, delay aging and enable one to live long. It stabilizes ones mental condition. The importance of retaining memory into old age probably lies in the Taoist belief that sickness was caused by past transgressions and that the patient had to remember the transgressions, record them and destroy the record. This belief placed a strong emphasis on memory in the maintenance of health and longevity.⁵⁵

Energetic: *Ling zhi* is listed as sweet, mild flavour with a warm property. Its action is nourishing, supplementing, tonifying. It removes toxins, disperses accumulation, and stops tightness in the chest.⁵⁶

Pharmacy and dosage:

Dosage

1 - 15 gms daily, with 3 - 6 gms being the most common recommendation.

Official Recognition and Medical References

Peoples Republic Pharm.

Licensing: As of April 01. 11 there have been 31 licenses by the NHP given for products contain *Ganoderma* in them

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Cordyceps sinensis

Family - Clavicipitaceae

Common names: Dong chong xia cao,
Caterpillar fungus, “winter bug summer herb”
冬虫夏草

Plant description: Cordyceps is drawn from a 2 - 11 cm long single (rarely 2 - 3) fruiting body (stoma) growing out of the anterior end of insect larvae. This fungus, plus the insect it grows on, are found in mountains at elevations 3,000 m or above ... especially cold, snowy grassy marshlands with good drainage. There are several commercial growers that have worked out methods of growing the Cordyceps on a mycelium base and this process has vastly increased the availability of the herb.



Habitat, ecology and distribution:

Cordyceps is found in the highlands of China, Tibet, and Nepal, above 10,000 feet.

Part used: Fruiting body with insect parts, mycelium base

Harvesting and collection: Most cordyceps present in the health food industry is growing on grain and used as a mycelium mass. In early spring when the snow is just melting, people crawl on the ground to search for the smaller than finger size mushroom. It is literally a fungus that grows on the bat moth caterpillar. Its price can be more than its weight in gold. Since it is very rare and expensive, Chinese scientists have found a way to cultivate it. The cultivated version of this herb is made from the dried mycelia powder, usually grown on organic grain, so there are no animal by products in it.



Constituents: Cordyceps contains highly branched polysaccharides (CS-1 and CS-2), fatty acids, and adenosine, cordycepic acid, cordycepin, glutamic acid, phenylalanine, uracil, uridine, adenine and adenosine, proline, histidine, valine, oxyvaline, ophiocordin, arginine, d-mannitol and Vit B₁₂.^{1,2,3,4}

The chemical constituents of *C. sinensis* were first studied by Chatterjee et al. in 1957. A crystalline substance was isolated and named “cordycepic acid”, and was then identified by Sprecher and Sprinson as D-mannitol. Further studies on the chemical constituents of Cordyceps revealed the presence of a series of known substances, but new structures or compounds with significant pharmacological efficacy were not found. The chemical constituents isolated from *C. sinensis* were amino acids, stearic acid, D-mannitol, mycose, ergosterol, uracil, adenine, adenosine, palmitic acid, cholesterolpalmitate and 5a-8a-epidioxy-5a-ergosta-6,22 dien-3 β -ol (48-1).^{5,6,7,8}



Medical Research:

It has a long history of use in China and Tibet, but has also been used by indigenous peoples around the world.⁹ Cordyceps is specific for the respiratory tract, working as a bronchial dilator. Heavily used by athletes, Cordyceps aids in both getting more oxygen into the cells and increasing endurance.¹⁰ Cordyceps is used mostly for relief from bronchial inflammation and as an expectorant. It is well known to relieve exhaustion, night sweats, sexual impotency and acts as a sedative. It benefits the kidneys, lungs and gonadal function. It is specific for uterine fibroids. Cordyceps will stimulate immune function (due to CS-1) by activating T-cells and B-cells, while increasing interleukin-1 (but not 2) and gamma-interferon. It has also been shown to increase erythroid progenitor cells and erythroid colony-forming units in bone marrow. Sedative and even hypnotic activity can be attributed to the amino acid content. Reduction of cholesterol and plasma triglycerides has been observed, as well as increased spermatogenesis. Improvement in arrhythmia, in chronic kidney problems, liver function after hepatitis B, and good success with treating tinnitus, have all been observed.¹¹ It has been used: against cancer,^{12, 13} as an anti-depressant,¹⁴ to promote cellular health,^{15,16} to regulate blood lipids,^{17,18,19} for the inhibition of infection and reverse transcriptase activity of human immunodeficiency virus;²⁰ to increase both male and female fertility and as an aphrodisiac.²¹

The therapeutic effects of this extraordinary mushroom have been confirmed in many controlled and well designed studies carried out by many medical schools. There are literally hundreds of scientific papers written on this fungus over the last ten years. The following are just a few. Several studies on respiratory function all showed improved oxygen uptake, for health issues like chronic bronchitis and asthma. A study done on 30 elderly volunteers showed significant improvement of oxygen uptake and assimilation. Studies done on blood lipids found a 10 - 21% decrease in total cholesterol, 27 - 30% increase of HDL (“good cholesterol”), 9 - 26% reduction in triglycerides. One study of 155 males with low sexual function produced increased performance in 64.5% for cordyceps consumers, compared to 31% for placebo. All 33 cases of hepatitis B found improved liver function in one study; while another with 256 cases of chronic viral hepatitis showed an 80% improvement. Several studies show increased immune function, while consuming Cordyceps.^{22, 23, 24}

In Europe there has been lot of studies done on Cordyceps, here are some highlights: it has been shown to inhibit the production of DNA and RNA synthesis in cancer cell.²⁵ Enhancement of cell differentiation;²⁶ restructuring of cytoskeleton in cells;²⁷ inhibition of protein kinase activity;²⁸ antitumor activity on bladder, kidney, colon, lung carcinoma as well as fibroblastoma;²⁹ inhibition of the infection and reverse transcriptase activity of human immunodeficiency virus;³⁰ type I inhibition of methylation of nucleic acid;³¹ and inhibition of chemotaxis and specific proteins synthesis of the macrophage cell line.³²

Both natural Cordyceps and cultured mycelia of *C. sinensis* have significant effects on the immune system of mice. They can increase the size of the spleen, decrease the size of the thymus, and prevent atrophy of spleen and liver and hypertrophy of the thymus in

mice induced by cyclophosphamide.³³ The DNA, RNA, and protein contents in the enlarged spleen were significantly increased. The effect of the thymus was abolished by adrenalectomy. The active principle was found to be present in the stroma rather than in the lanra.³⁴

The aqueous extracts of natural *Cordyceps* and the cultured mycelia of *C. sinensis* can enhance the production of macrophages and activate the functions of the phagocytic system. They not only enhance the phagocytic activity of the macrophages, but also increase the alkaline phosphatase activity of the macrophages.³⁵ In addition, serum hemolysin and sponcytic immunohemolytic activities were elevated in mice immune suppressed by hydrocortisone.

In normal mice, however, no such regulatory effect on humoral immunity was observed.³⁶ The polysaccharide of *C. sinensis* also showed immunostimulating activity in mice. It activated the phagocytic function of the reticuloendothelial system and of macrophages in the abdominal cavity and increased blood serum IgG and plasma corticosterone levels and spleen weight. The polysaccharide also antagonized spleen atrophy and leukocyte decrease induced by cortisone and cyclophosphamide, and the reduction of phagocytic function of macrophages in the abdominal cavity, but did not inhibit the anti-inflammatory function of cortisone.³⁷

Some results of clinical studies with *C. sinensis* for treatment of tinnitus, chronic nephritis, arrhythmia, and sexual hypofunction were recently reported. For instance, treatment with *C. sinensis* significantly decreased proteinuria of the patients with chronic nephritis in 24 h. Two patients with hematuria as the major clinical manifestation responded with strongly decreased erythrocyte counts in urine.^{38, 39, 40, 41,42}

The Beijing Institute of Material Medica of the Chinese Medical Academy made extensive pharmacological studies and found that the cultivated version has the same chemical components and the same physiological effects as the natural products.⁴³

Toxicity: The toxicity is very low when taken orally. No abnormal blood, urine, liver or kidney function have been observed in normal dosage range. Intraperitoneal injection of 5 g/Kg showed no problem, but 30 - 50 g/Kg was universally fatal in animal studies. Safety study on mice using up to 200 times the usual human dose for 30 days did not show any significant side effects except for slight kidney swelling in only a few mice at the highest level (10 g/kg). No morphological changes were seen in mice given up to 60 times the usual human dose for 90 days. No LD50 (lethal to 50%) dose has been found. Generally safe for appropriate consumption.⁴⁴

Herbal action: Expectorant, immuno-stimulant, diuretic, impotency

Indications: athletic endurance, bronchial inflammation, immunomodulator, tonic to lungs, kidney, gonads, lower blood lipid, cancer

Medicinal uses: Cordyceps attracted the attention of the general public and the health profession in 1993 when a group of Chinese runners broke nine world records in the World Outdoor Track and Field Championships in Germany. Afterwards the coach attributed those results to the athletes regular use of a cordyceps based tonic. It is now used by both olympian and professional athletes worldwide. It is not restricted as an athletic enhancing substance, because it is considered food.

The major active constituents are attributed to a group of polysaccharides that produce strong tonic effects, increase oxygen uptake in the lungs by opening up the bronchial tubes, while reducing bronchial inflammation and working as an expectorant. It is well known to relieve exhaustion, night sweats, sexual impotency and function as a sedative. Cordyceps will increase immune function (T-cells, B-cells, interleukin-1 and gamma-interferon); anti-tumor function; reduce cholesterol (beneficially adjusting HDL/LDL ratio), and plasma triglycerides; as well as increasing spermatogenesis and sex drive. Other conditions it benefits include improvement in arrhythmias; chronic kidney problems; liver function after hepatitis B, and good success with treating tinnitus. It is specific for uterine fibroids. A calming sedative activity can be attributed to the amino acid content. Cordyceps has been used as an antidote to opium addiction.

Energetics: Cordyceps enters the Kidney and Lung meridians.⁴⁵

Pharmacy and dosage:

Dosage^{46,47}

Fruiting Body	2 - 9 g twice daily.
Extract	1 g twice daily

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***Grifola frondosa* Maitake**

Family - Basidiomycetes

Common names: Dancing Mushroom, Hen of the woods

The scientific name of Maitake (pronounced my-tah-keh), *Grifola frondosa* comes from the common name of a fungus found in Italy. This name refers to a mythical beast which is half-lion and half-eagle. The Japanese name "Maitake" is associated with its shape, which some believe resembles a dancing nymph. It is also said that this name comes from "Dancing fungus", because the person who finds it dances with joy.¹



Plant description: Maitake is a very large mushroom (the size of a basketball), which grows deep in the mountains of northeastern Japan, as well as in North America and Europe. The typical maitake is light or golden-brown in color. Maitake is extremely sensitive to environmental changes, which makes it difficult to grow in most areas.

Habitat, ecology and distribution: Maitake grows in the northern part of the Temperate Zone in the Northern Hemisphere and is found throughout Japan, Europe, and North America. At the base of old hardwood, especially *Quercus mongolica* var. *grosseserrata* in woods, also *Castanopsis cuspidata* var. *Sieboldii* in the parks, as well as on the trunks and roots. Wild Maitake can be harvested in September/October. It forms large heads, mainly near the roots of big fagaceous trees such as Mizunara, *Quercus crispula*, *Buna*, *Fagus crenata*, and *Shiinoki*, *Castanopsis cuspidata*. It is one of the fungi which invades the core of these trees. It decomposes lignin and leaves and cellulose. It is the cause of so-called white rot. Wild Maitake has a good taste, a crisp texture, and an excellent aroma. It is considered a first-rank edible mushroom.

Part used: Fruiting body and mycelium

Harvesting and collection: Japan is the major producer and consumer of *G. frondosa* (Maitake). Commercial production of maitake in Japan began in 1981. By 1986, production was 2,203 t and, by 1991, production reached 7,950 t (a 261% increase). Japanese production of maitake reached 9,617 t in 1993 and was produced primarily in the provinces of Niigata, Nagano, Gunma, and Shizuoka.

History: Maitake is used as a Chinese medicine called "Keisho". "Shen Nong Ben Cao jing" (Shen Nong's scripture of herbal medicine) states that it has been frequently used for improving spleen and stomach Qi, calming nerves and mind, and treating hemorrhoids.



Historically, maitake has been used as a tonic and adaptogen. Traditionally, consumption of the mushroom was thought to prevent high blood pressure and cancer—two applications that have been the focal point of modern research. For thousands of years Maitake mushrooms have been revered in China and Japan as a food to maintain health, preserve youth, and increase longevity.

Most Maitake is marketed as food. However, Maitake has been shown to have both anti-tumor and anti-viral properties. Powdered fruitbodies are used in the production of many health foods such as Maitake tea, whole powder, granules, drinks, and tablets. The medicinal properties of the maitake mushroom has been studied since the mid 1980's.

Constituents: Polysaccharides (1,6 beta-glucans consisting mainly of beta-D-glucan), thiamin and riboflavin.

Medical Research:

This edible mushroom has been extensively researched as an adaptogen and for its effect against cancer.^{2,3} The primary polysaccharide, beta-D-glucan, is well absorbed when taken orally and is currently under review for the prevention and treatment of cancer and as a supportive tool for HIV infection. It has been shown to stimulate the immune system. Animal studies suggest Maitake may lower fat levels in the blood and lower blood pressure.^{4, 5, 6, 7, 8,9} Maitake is shown to inhibit angiogenesis.¹⁰ The blood sugar lowering effect of Maitake is well researched, with a naturally occurring alpha glucosidase inhibitor found.^{11,12,13,14} Maitake's antioxidant effect may due to it partially inhibiting cyclooxygenase.¹⁵

A common denominator among mushroom and herbal adaptogens is the presence of complex polysaccharides in their structure. These active components have the ability to act as immuno-modulators and, as such, are researched for their potential role in cancer and AIDS treatment. The polysaccharides present in maitake have a unique structure and are among the most powerful studied to date. The primary polysaccharide, beta-D-glucan, is well absorbed when taken orally and is currently under review for the prevention and treatment of cancer and as a supportive tool for HIV infection. Animal studies suggest maitake may lower fat levels in the blood and lower blood pressure.^{16, 17, 18, 19, 20}

Polysaccharide fractions of maitake mushroom have been shown to have chemoprotective effects, delay or halt tumor growth, and help block the spread of cancer. Maitake extracts stimulate the activity of several types of immune cells (including macrophages and natural killer cells) which in turn trigger production of interleukins and other lymphokines -- chemicals that help mediate the immune response. In addition, maitake mushroom inhibits some of the biochemical mechanisms that promote metastasis of cancer cells in the lymph and bloodstream.



Because it significantly reduced the size of mammary tumors in mice, Maitake D-fraction is now being used in clinical trials of women with breast cancer. The first studies, which had promising results, were not from randomized controlled trials. One such study reported significant improvement of symptoms and/or tumor in 11 out of 15 breast cancer patients who had standard chemotherapy and maitake.

Investigations are currently underway in Japan and the United States on the adjunctive immune-stimulating and antitumor properties of maitake. In early 1998, Maitake Products, Inc, received FDA approval for an IND (Investigational New Drug Application) to conduct a Phase II pilot study on the efficacy of a maitake "D-fraction in treating advanced breast and prostate cancer patients. A clinical trial has been planned to evaluate the effects of this extract .

Toxicity: edible mushroom

Herbal action: immune-modulator, tonic, nervine

Indications: Cancer, hepatitis, AIDS, immune issues

Contraindications and cautions: Used as recommended above, there have been very few reports of side effects with maitake.. Side effects are usual limited to mild indigestion and/or loose stools. Because little is known about how maitake affects the fetus or infant, women who are pregnant or nursing should not take maitake mushroom or maitake mushroom extracts.

Medicinal uses: Anti-viral, anti-tumor, anti-diabetic and also the subject of research against HIV, this mushroom is a delicious, soft-fleshed polypore with excellent nutritional properties. Of all the polypores currently being studied, *Grifola frondosa* is attracting considerable attention from the pharmaceutical industry, especially in Korea and Japan.

Pharmacy and dosage: Pharmacy and dosage.

Maitake mushroom: 3-7 grams per day.

Standardized liquid extract: 5 to 20 drops 3 times a day.

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Coriolus versicolor -PSK

Medicinal Mushroom

Common names: syn Trametes versicolor; turkey tail, Yun Zhi, cloud mushroom, Kawaratake, mushroom by the river; PSK, 云芝



Plant description: This woody, shelf-like fruiting bodies form dense, overlapping clusters on stumps, tree trunks, and fallen trees. The mushroom caps have a plush velvety surface and are colored in varying shades of brown or gray, with a distinctive pattern of alternating bands of dark and light color.

Habitat, ecology and distribution: Coriolus versicolor is found throughout the wooded temperate zones of North America, Asia, and Europe and may be the most prolific shelf fungus in the Northern Hemisphere. In Classical Chinese and Japanese herbalism the fruit bodies (mushrooms) are harvested, dried, ground to a powder and made into tea.

Part used: Fruiting body

Harvesting and collection: collected in fall off of trees

History: In China Coriolus versicolor is known as "Yun zhi", or the "cloud mushroom". In Japan it is called "Kawaratake", or "mushroom by the river". In traditional herbalism hot water extracts of Coriolus. The Ming dynasty edition of the Materia Medica states that "The black and green Yun zhi are beneficial to one's spirit and vital energy, and strengthen one's tendon and bone. If Yun zhi is taken for a long time, it will make one vigorous and live long." In Japan these mushrooms are also highly prized and sought after by people suffering from a variety of cancers. It was this popularity as a "folk remedy" that first got the attention of modern researchers.¹

The Coriolus extract was so successful that the cost to Japan's national health insurance program reached almost a billion dollars a year. In an attempt to reduce expenditures the Health Ministry restricted the use of the Coriolus extract to those people most in need, people receiving chemotherapy or radiation. Clinical research has consistently demonstrated the ability of Coriolus beta glucans to double and even triple survival rates for people receiving chemotherapy and radiation.

Its traditional functions are to:



1. Invigorate the Spleen and eliminate dampness: For Spleen-deficiency patterns with anorexia and loose stools. Recently, used for hepatitis, hepatocirrhosis, nephritis, rheumatoid arthritis, etc.
2. Relieve cough and dyspnoea
3. Modern Chinese applications: Anticarcinogenic: For leukaemia, lymphoma, early stage of liver cancer, and cancers of the stomach, breast and cervix.

Constituents: The main component unit of the polysaccharide moiety is a B-glucan, with the main chain consisting of B-(1-4) glucose polymer branched at positions 3 and 6 of the glucose.²

Medical Research:

This mushroom and its isolates are some of the most studied of all medicinal mushrooms. In particular is the glucan-protein complex of Polysaccharide-K (Kresin, PSK, PSP) that is used in cancer therapy to counter-act the immune depressing action of common chemotherapy. Approved in 1980 by the Japanese equivalent to the FDA for concurrent use with chemotherapy, it is covered by all health care plans in Japan.³ Both the isolate and the mushroom have been shown to increase survival time of cancer patients.⁴ In large studies it has also been shown to be useful in stomach cancer, colorectal cancer,⁵ small cell carcinoma,⁶ and non-small cell lung carcinoma.⁷ PSK has been shown to enhance activity of chemotherapeutic drugs doxorubin and etoposide.^{8,9} US cancer doctors have seen both PSK and whole mushroom extract to have promises for chemoprevention due to multiple effects on the malignant process and reducing side effect of oral dosage.¹⁰ These studies, published in *Lancet*, found the results to be significant.^{11, 12, 13} The sales for these unique all-natural compounds have reached several hundred million dollars a year in Japan and China, making them the most widely used products in those countries by people facing serious immune challenges.¹⁴

There has been great interest in *Coriolus*' ability to work as an antiviral including HIV, HPV hepatitis and many other viruses.^{15,16}

The focus of the modern clinical use and research (over 400 published studies), has been the immuno-modulating and anti-tumor properties of the hot water extracted polysaccharides. Originally isolated from the fruiting body (the mushroom), sales for these unique all-natural compounds have reached several hundred million dollars a year in Japan and China, making them the most widely used products in those countries by people facing serious immune challenges.¹⁷ Based on its reputation for healing within their traditional herbal practices Chinese and Japanese scientists began to do controlled clinical research on concentrated hot water extracts from *Coriolus*, studying the same 1-4, 1-3 polysaccharides (beta glucans) that would have been released into solution when making the hot water teas described in the texts from traditional Japanese and Chinese herbalism.

After placebo controlled clinical research demonstrated significant immuno-modulating properties the *Coriolus* 1-4, 1-3 polysaccharides (beta glucans) were approved as a



pharmaceutical product by the Japanese Health Ministry, allowing health insurance to cover the cost of its use.

At this point the Coriolus extract began to get widespread use by Japanese oncologists. Coriolus polysaccharides were used in practice to support immune health after surgical treatment for various conditions and to support and protect immune health in those patients receiving therapies where immune suppression is a prominent feature. Private and government sponsored research continued to monitor the effectiveness of the highly concentrated Coriolus extract in placebo controlled multi-institutional clinical studies, with the clinical evidence demonstrating significant immune benefit from daily use^{18,19,20,21,22,23,24,25}

PSK acts as an immuno-modulator and is used primarily in conjunction with chemotherapy, radiation, and surgical treatments for cancer. Clinical studies have demonstrated significant results, results that would make headlines if obtained through conventional treatments: 30% vs. 10% disease-free survival for colon cancer patients over an eight-year clinical trial when PSK was used alone and tested against a placebo; 22% vs. 5% survival at five years for stage III lung cancer patients who were given radiation plus PSK as opposed to radiation alone; 81% vs. 64% survival at ten years for breast cancer patients who were given chemotherapy plus PSK as opposed to chemotherapy alone; 73% vs. 60% survival at five years for gastric cancer patients who combined daily PSK use with their chemotherapy as opposed to chemotherapy alone. This study, published in Lancet, found these results to be significant^{26,27,28}

Pharmacologic properties in animals and humans have been extensively evaluated. PSK has a human metabolic half-life of 18 hours with the primary route of excretion being through the lungs. It requires very little dependence upon renal or hepatic elimination, and in fact has shown benefit in the treatment of hepatitis B and chronic hepatitis. JHS is currently working with the National College of Naturopathic Medicine to develop and fund an independent study of PSK's influence on chronic hepatitis C.²⁹

There has been some study on HIV patient, especially with Kaposi's Sarcoma and it appears good, but more study is needed

Toxicity: PSK has complied with LD-50 and other safety evaluations in Japan and has been found to be extremely safe. In the US, PSK is marketed as a food supplement and LD-50 tests have not been required.

Herbal action: Tonic, immunomodulator

Indications: Hepatitis, Cancer, Immune issues, Chemo or radiation therapy

Energetic: used to dispel dampness, reduce phlegm, treat pulmonary infections, and to support liver health.³⁰



Pharmacy and dosage:

2-6 capsules per day

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Lentinus edodes - SHIITAKE

Family - *Tricholomataceae*

Common names: snake butter, pasania fungus, forest mushroom, Hua Gu, Japanese forest mushroom, *Lentinula edodes*, 椎茸, 香菇, 平菇

Plant description: A fawn coloured subfleshy mushroom with scales, 5 - 12 cm broad, convex. Gills decurrent (even ragged) white, centric, ring narrow, spore hyaline. Found on broad leaf hardwoods. Well known edible fungi.



Habitat, ecology and distribution: Wild shiitake mushrooms are native to Japan, China, and other Asian countries and typically grow on fallen broadleaf trees in temperate regions. Shiitake is now widely cultivated throughout the world, including the United States. Various species of trees have been used for the cultivation of shiitake. One of the primary species used in one area of Japan in past years was the shii tree--thus the derivation of the name shii-take. Most production today, however, is on various species of oak.

Part used: Whole fruiting body and mycelium.

Harvesting and collection: The cultivation of *L. edodes* (shiitake) first began in China about AD 1100. It is believed that shiitake cultivation techniques developed in China were introduced to the Japanese by Chinese growers.

History: Shiitake has been revered in Japan and China as both a food and medicinal herb for thousands of years. Wu Ri, a famous physician from the Chinese Ming Dynasty era (A.D. 1368–1644), wrote extensively about this mushroom, noting its ability to increase energy, cure colds, and eliminate worms. This mushroom has been a favourite in many dishes in the Orient. The mushroom fruiting body was considered as a tonic. The stems of the mushroom were the ones that were most often used in medicine. This is probably due to the fact that they are not as tasty, being a bit tough and not as desirable for the table.¹

Constituents: Contains many of the essential amino acids, ergosterol (pro-vitamin D), branched polysaccharide (lentinan), eritandenine. Protein (2.2 - 2.6 fresh, 25.6 dry), lipids (linoleic acid), calcium, zinc, magnesium, vitamins B2 and C.^{2,3,4}



Medical Research:

This edible mushroom has been used extensively as a folk remedy in the Orient. It has been shown to stimulate the immune system,⁵ and possess anti-bacterial^{6,7,8} and anti-viral properties.^{9,10,11} Shiitake has been shown to reduce platelet aggregation,¹² and lower cholesterol.¹³ The mushroom and more importantly the mycelium extract lentinan has shown activity against many strains of cancer, especially gastric cancer.^{14,15,16,17,18} The list of studied done on shiitake is impressive; here are some of the highlights: dermatitis, liver cirrhosis, vascular sclerosis, lower blood pressure, reduce blood cholesterol, prevents toxicity from acid foods, inhibits growths of sarcoma 180 (97.5%) and Ehrlich carcinoma (80%), used successfully for chronic fatigue syndrome. LEM (*Lentinus edodes* mycelium) is often the form used.¹⁹

The antitumor function and much of the immunoregulatory action is due to the polysaccharide (a mannan-peptide complex, KS-2 and others). The lentinan complex has been shown to involve the adrenal-pituitary axis and central-peripheral nervous system (including serotonin, histamine and catecholamines) in its antitumour activity. Shiitake or LEM (*Lentinus edodes* mycelium extract) appears to be helpful during chemotherapy by reducing tumors and the side effects of chemotherapy. Lentinan has been shown to activate natural killer (NK) cells *in vitro* as well as T-helper cells, interleukin 2, interleukin 1, Igs production, interferon, macrophage secretion and produce cytokines.

While many of the above functions have to do with tumors and the immune system, strong antiviral effects have also been recorded. Shiitake has shown effectiveness against viruses ranging from influenza to HIV, as well as being able to enhance recovery of affected areas (such as restoration of T-helper cells). Spores from the fruiting body have been shown to cause immunity to type A influenza up to six months. This is thought to be due to the spore having similar chemical coding on its surface.

Its antibacterial and antiparasitic effects seem to also be due to lentinan. LEM has been shown to have strong liver protective properties, slowing growth of liver tumours and speed up recovery from hepatitis B. Eritadenine has been shown to lower cholesterol and blood lipids.^{20,21}

Research indicates that lentinan injections may help some people with hepatitis.²² Other open human studies have looked at oral shiitake and found it useful for people with hepatitis B.²³ A highly purified intravenous form of lentinan has been employed in Japan to increase survival in those with recurrent stomach cancer (particularly when used in combination with chemotherapy).²⁴ These effects may be due to shiitake's ability to stimulate specific types of white blood cells called T-lymphocytes. Case reports from Japan are also suggestive that lentinan is helpful in treating individuals with HIV infection. However, large-scale clinical trials to confirm this action have not yet been performed.



Lentinan raises levels of interleukin-1 and interferon, two key chemical mediators that help regulate the immune system. In addition, lentinan activates key tumor-fighting cells in the immune system such as T-cells and natural killer cells. Some of the active constituents in shiitake mushroom also prevent the formation of carcinogens from nitrates in processed foods. Mice with cancer that were fed large quantities of shiitake mushroom in their diets also had a decrease in the development of their tumors. A diet containing up to 10% of shiitake mice fed to mice with cancer reduced tumor development in the test animals by almost 40%. And a diet of 30% shiitake mushroom blocked tumor growth by as much as 78%.

Evidence for anti-cancer activity: Most of the evidence comes from studies in mice with transplanted or chemically induced tumors. A diet containing up to 10% of shiitake reduced tumor development in mice by almost 40%; a diet of 30% shiitake mushroom blocked tumor growth by as much as 78%.

In a 1983 study, the effects of bacterial lipopolysaccharide administered alone and in conjunction with lentinan were measure in mice with transplanted tumors. The combined treatment was more effective in decreasing tumor size and weight than were those of lipopolysaccharide alone.

In a clinical trial conducted in Japan, lentinan given to cancer patients concomitant with chemotherapy enhanced the efficacy of chemotherapy and inhibited tumor development.

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In a clinical trial conducted in Japan, lentinan given to cancer patients concomitant with chemotherapy enhanced the efficacy of chemotherapy and inhibited tumor development.

Toxicity: edible mushroom.

Herbal action: Antitumor, Immunoregulation, hepatic tonic, antibiotic, cardiovascular tonic, lipid control.

Indications: dermatitis, liver cirrhosis, vascular sclerosis, high blood pressure, high blood cholesterol, antitumor, hepatitis, immuno-modulator, HIV



Contraindications and cautions: Non-toxic food item. Some people have mild allergies to shiitake and has been known to induce temporary diarrhoea and abdominal bloating when used in high amounts (above 15–20 grams per day). The fruiting body and LEM are safe to eat if a person has a *Candida* overgrowth.

Medicinal uses: Shiitake A staple of the Asian diet, shiitake has also had a medicinal role as a tonic and stimulant, and in traditional Chinese medicine to treat circulatory disorders and colds, and as an appetite suppressant. Shiitake is also a food staple in Asia, particularly Japan, and increasingly so in the world. Today, many alternative health care practitioners prescribe shiitake for stroke prevention, much as aspirin is prescribed by medical doctors.

Energetics: sweet, mild strengthening and restorative.²⁵

Pharmacy and dosage:

Dosage

This mushroom is usually eaten by the plateful
(6 - 16 gms, but up to 90 gms)

LEM 2 - 6 gms over the day, at beginning.

1/2 - 1 gm per day after stable.

Lentinan IV 1 mg strengthens immune system,
10 mg suppresses.

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Other Medicinal Mushrooms

Chaga mushroom (*Inonotus obliquus*, *Kabanoanatake*): This mushroom has been used for at least several hundred years in Russia and Eastern Europe and is well known and used extensively by indigenous people of northern Canada, Europe and Siberia. In Russia an extract of Chaga is known as befungin and is an approved medicine.¹ Known for its anti-cancer properties and immunomodulating qualities it has been heavily researched.^{2,3,4} It is known to increase survival rates⁵ of test animals. Growing mostly on birch trees it contains betulin and inotodiol, that have shown promise in leukemia models.^{6,7} Employed as an antioxidant it is starting to get quite a reputation.^{8,9} Chaga can be used as an anti-inflammatory reducing pain sensation.¹⁰ Blood sugar regulating properties have also been noticed for this mushroom.¹¹



Agaricus blazei (*Agaricus subrufescens*; Kawarahiratake, Himematsutake, 姬松茸)



This very popular mushroom is used extensively in the Orient, although it was initially discovered in South America. Agaricus is used to stimulate the immune system and against a large range of cancers.¹² With over 500,000 people using this mushroom it is considered one of the more popular alternative remedies in the Orient.¹³ It has been shown to inhibit angiogenesis,¹⁴ as well as having a wide ranging effect against viruses and other pathogenic factors.^{15,16,17} There is ongoing research on its effect on lowering cholesterol¹⁸ and blood sugar levels.^{19,20}



Oyster mushroom (*Pleurotus ostreatus*, Hiratake, píng gū, 平菇) has been shown to lower cholesterol, with a naturally occurring statin drug Lovastatin in it. Both in vivo and vitro studies show effects against breast and colon cancers due to beta-glucans.^{21,22,23}



Lion's Mane (*Hericium erinaceus*; Yamabushitake, 山伏茸, 猴头菇): works mostly on the nervous system, it has been used to combat dementia and to stimulate nerve cellular growth,^{24,25} while stimulating myelination²⁶ and improve cognitive ability.²⁷



Enokitake (*Flammulina velutipes*; えのき茸, 팽이버섯): is an edible mushroom that through epidemiological studies has shown to have anti-tumor activity.²⁸ One of the isolated compounds (proflamin) has been shown to produce an 85% longer survival rate in mice with cancer.²⁹ Enokitake also has an antioxidant effect.³⁰

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