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5 citations found (24/11/97)

Anticancer Res 1997 Jan;**17(1A):**277-284

Antitumor effects of a new polysaccharide-protein complex (ATOM) prepared from Agaricus blazei (Iwade strain 101) "Himematsutake" and its mechanisms in tumor-bearing mice.

Ito H, Shimura K, Itoh H, Kawade M

The antitumor activity of the i.p. or p.o. administration of polysaccharide-protein complex, ATOM (antitumor organic substance Mie) prepared from cultured mycelia of Agaricus blazei (Iwade strain 101) "Himematsutake" examined against four kinds of established mouse tumors. ATOM was highly effective at the doses of 10 and 20 mg/kg/day x 10 on subcutaneously implanted Sarcoma 180 in mice, and was also active against Ehrlich ascites carcinoma, Shionogi carcinoma 42 and Meth A fibrosarcoma at doses of 50 and 100 mg/kg/day x 10. ATOM has no direct cytotoxic action on tumor cells in vitro. Thus the tumor growth-inhibitory effect of ATOM is apparently due to immunological host-mediated mechanisms. The number of peritoneal macrophages, the phagocytosis of polystyrene latex beads and the proportion of the third component of complement (C3)-positive fluorescent cells were increased in the mice treated with ATOM. These results suggest that the macrophage activa-tion and alterations of the C3 are necessary for the induction of an antitumor effect of ATOM.

PMID: 9066665, UI: 97219365

Jpn J Pharmacol 1994 Oct;**66(2):**265-271

Inhibitory action of a (1-->6)-beta-D-glucan-protein complex (F III-2-b) isolated from Agaricus blazei Murill ("himematsutake") on Meth A fibrosarcoma-bearing mice and its antitumor mechanism.

Itoh H, Ito H, Amano H, Noda H

The effects of F III-2-b (Agaricus blazei Murill polysaccharide) with or without 5-fluorouracil (5-FU) on immune responses were investigated in Meth A tumor-bearing and normal mice. The i.p. administration of F III-2-b (10 mg/kg/day x 30) moderately inhibited the growth of Meth A tumor cells implanted s.c. in mice. Development of implanted tumors was strongly inhibited by the combination of F III-2-b and 5-FU. The picryl chloride-induced delayed type hypersensitivity (PC-DTH) response in mice was depressed after the implantation of tumor and treatment with 5-FU. F III-2-b restored the suppression of PC-DTH by 5-FU, but did not increase the PC-DTH of normal mice. F III-2-b not only enhanced the degree of spleen cell-mediated sheep red blood cells (SRBC) hemolysis (quantitative hemolysis of SRBC), the indexes of the spleen and thymus, and the number of spleen cells but also restored the suppressive effect of 5-FU. In the group receiving F III-2-b, the percentages of splenic Thy1.2-, L3T4- and asialo GM1-positive cells were significantly increased as compared with the tumor-bearing mice treated with saline. Furthermore, the L3T4+/Lyt2+ ratio showed a tendency to increase, and the Lyt2+ ratio was markedly decreased. These results suggest that the antitumor effect of F III-2-b may be correlated with the changing pattern of the Thy1.2-, L3T4- and asialo GM1-positive cells.

PMID: 7869611, UI: 95174220

Yakugaku Zasshi 1994 May;**114(5):**342-350

[Antimutagenic and bactericidal substances in the fruit body of a Basidiomycete Agaricus blazei, Jun-17].

[Article in Japanese]

Osaki Y, Kato T, Yamamoto K, Okubo J, Miyazaki T

The fruit body of a Basidiomycete Agaricus blazei, Jun-17 (Himematsutake) was extracted with hexane and chloroform-methanol (2:1, v/v), and the antimutagenic effect of the extracts was examined using an Ames/Salmonella/microsome assay. Both extracts of Agaricus inhibited the mutagenicity of benzo[a]pyrene(B[a]P). The hexane extract was purified by silica gel column chromatography and high performance liquid chromatography (HPLC), and linoleic acid was isolated as a main substance having antimutagenic activity. Fr. IIa, IIb, IIc and IIb, which reduced the number of His+ revertant colonies induced by B[a]P, were separated from the chloroform-methanol extract by silica gel column chromatography and HPLC. An antimutagenic substance in Fr. IIa was linoleic acid. From Fr. IIb, a bactericidal, not antimutagenic, substance was isolated and identified as 13-hydroxy cis-9, trans-11-octadecadienoic acid (13ZE-LOH). Antimutagenic substances in Fr. IIc and IId were not purified. The possible source and mechanism of formation of 13ZE-LOH are discussed.

PMID: 8014843, UI: 94285038

Carbohydr Res 1989 Mar 15;**186(2):**267-273

Fractionation and antitumor activity of the water-insoluble residue of Agaricus blazei fruiting bodies.

Kawagishi H, Inagaki R, Kanao T, Mizuno T, Shimura K, Ito H, Hagiwara T, Nakamura T

Some polysaccharide-containing materials were successively extracted from the fruiting bodies of Agaricus blazei with aqueous ammonium oxalate and sodium hydroxide, fractionated, and assayed for antitumor activity. From chemical analyses and n.m.r. data, it was concluded that the most active fraction, FIII-2-b, was comprised of protein and a (1----6)-beta-D-glucan.

PMID: 2736561, UI: 89288117

Carbohydr Res 1988 Nov 15;**183(1):**150-154

Isolation and properties of a lectin from the fruiting bodies of Agaricus blazei.

Kawagishi H, Nomura A, Yumen T, Mizuno T, Hagiwara T, Nakamura T

PMID: 3233595, UI: 89168256

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8 citations found

Biopolymers 1995 Dec;**36(6):**695-700

Properties of Auricularia auricula-judae beta-D-glucan in dilute solution.

Zhang L, Yang L

A water-soluble glucan A was isolated from the fruit body of Auricularia auricula-judae. It is composed of a backbone chain of beta-(1-->3)-linked D-glucose residues, two out of three glucose residues being substituted at C-6 positions with a single glucose unit. The weight average molecular weight Mw, number average molecular weight Mn, and intrinsic viscosity [eta] of the fractionated samples were studied at 25 degrees C in water and in dimethylsulfoxide (DMSO). The Mark-Houwink equation was established as [eta] = 6.10 x 10(-4) Mw1.14 for the glucan A having Mw ranging from 9 x 10(5) to 1.6 x 10(6) in water. The values of [eta] in water are far higher than those in DMSO, but the values of Mn measured in water are the same as those in DMSO. Analysis of Mw and [eta] in terms of the known theories for rods and wormlike chains yielded 1030 +/- 100 nm-1, 90 +/- 20 nm, 1.3 +/- 0.3 nm, and 0.26 +/- 0.03 nm for molar mass per unit contour length ML, persistence length q, diameter d, and contour length h per main-chain glucose residue, respectively. The present data suggest that glucan A dissolves in water as single-stranded helical chains and in DMSO as semiflexible chains.

PMID: 8555417, UI: 96077012

***Chung Kuo Chung Yao Tsa Chih* 1994 Jul;19(7):430-432**

[Pharmacological actions of hyphae body of Auricularia auricula (L. ex Hook) Underw and its alcoholic extract].

[Article in Chinese]

Zeng XY, Li YD, He F, Chen LL, Lin MD

The percent peripheral blood T lymphocytes were elevated and HC50 reduction induced by cyclophosphamide was recovered after the hyphae body of Auricularia auricula had been ip administered in mice. The action of blood platelet agglutination in rats induced by ADP was inhibited and the time of erythrocytic electrophoresis in mice was shortened after the alcoholic extract had been ig administered.

PMID: 7802954, UI: 95101134

J Pharmacobiodyn 1983 Dec;**6(12):**983-990

Polysaccharides in fungi. XIV. Anti-inflammatory effect of the polysaccharides from the fruit bodies of several fungi.

Ukai S, Kiho T, Hara C, Kuruma I, Tanaka Y

Anti-inflammatory assays on the carrageenin-induced edema and scald-induced hyperalgesia in the hindpaw of rats were studied on polysaccharides obtained from the fruit bodies of various fungi (polysaccharide AC, BC: Tremella fuciformis;MEA, MHA, MCW-A, MCW-N: Auricularia auricula-judae; T-2-HN: Dictophora indusiata;G-A: Ganoderma japonicum). The purified polysaccharides MHA, MCW-A, G-A and T-2-HN exhibited a significant inhibitory effect on carrageenin edema. Among these polysaccharides, T-2-HN (partially O-acetylated alpha-D-mannan) also showed the marked inhibitory effect on scald hyperalgesia. We have found that T-2-HN has more potent anti-inflammatory activity than phenylbutazone in the above two inflammatory models. Since the purified polysaccharide is free from protein and lipid, it is clear that anti-inflammatory effect arises from the polysaccharide itself. The polysaccharides (T-2-HN, locust bean gun, xanthan gum) had little effect on the metabolism of arachidonic acid in canine platelets. The mechanism of the anti-inflammatory activity of the polysaccharide remains obscure.

PMID: 6425490, UI: 84187999

Nucleic Acids Res 1983 May 11;**11(9):**2871-2880

The nucleotide sequences of the 5S rRNAs of four mushrooms and their use in studying the phylogenetic position of basidiomycetes among the eukaryotes.

Huysmans E, Dams E, Vandenberghe A, De Wachter R

The nucleotide sequences of the 5 S ribosomal RNAs of the mushrooms Russula cyanoxantha, Pleurotus ostreatus, Agaricus edulis, and Auricularia auricula-judae were determined. The sequences fit in a universal five-helix secondary structure model for 5 S RNA. As in most other 5 S RNAs, some helical areas contain non-standard base pairs. A clustering method was used to reconstruct an evolutionary tree from 82 eukaryotic 5 S RNA sequences. It allows to make a choice between alternative systematic classifications for basidiomycetes and reveals that the fungal kingdom is highly polyphyletic.

PMID: 6856478, UI: 83220825

Chem Pharm Bull (Tokyo) 1983 Feb;**31(2):**741-744

Polysaccharides in fungi. XIII. Antitumor activity of various polysaccharides isolated from Dictyophora indusiata, Ganoderma japonicum, Cordyceps cicadae, Auricularia auricula-judae, and Auricularia species.

Ukai S, Kiho T, Hara C, Morita M, Goto A, Imaizumi N, Hasegawa Y

PMID: 6883594, UI: 83285550

***Thromb Haemost* 1982 Oct 29;48(2):162-165**

Inhibition of human and rat platelet aggregation by extracts of Mo-er

(Auricularia auricula).

Agarwal KC, Russo FX, Parks RE Jr

Hot water extracts of Mo-er (1 gm by 15 ml of water), an oriental food (Auricularia auricula), inhibit strongly both human and rat platelet ADP-induced aggregation. HPLC analysis of two varieties of Mo-er, A. auricula and A. polytricha (a black tree fungus), shows that they contain adenosine (Ado), 133 and 154 micrograms per gram of dry fungus, respectively. The inhibition of ADP-induced platelet aggregation by Mo-er extracts and by Ado was compared. Mo-er extracts caused a more rapid onset and a longer duration of inhibition that produced by equivalent amounts of Ado. Furthermore, Mo-er extract treated with adenosine deaminase to degrade the Ado retained the capacity to inhibit platelet aggregation. The inhibitory effects of Mo-er extracts of ADP-induced human platelet aggregation are greatly potentiated by the inhibitors of cyclic AMP phosphodiesterase such as oxagrelate (phthalazinol) and papaverine. The inhibition of platelet aggregation is only partially blocked by 2',5'-dideoxy-adenosine (DDA), an inhibitor of platelet adenylate cyclase and 5'-deoxy, 5'-methylthioadenosine (MTA), an antagonist of ADO receptors. ADP-induced rat platelet aggregation is strongly inhibited by Mo-er extracts, but not by Ado. This inhibition is not reversed by either DDA or MTA. These findings indicate that Mo-er extracts contain an agent (or agents) in addition to Ado, that blocks platelet aggregation by a mechanism that does not involve the platelet cyclic AMP system.

PMID: 6983740, UI: 83093814

Carbohydr Res 1981 May 18;**92(1):**115-129

Studies on interrelation of structure and antitumor effects of polysaccharides: antitumor action of periodate-modified, branched (1 goes to 3)-beta-D-glucan of Auricularia auricula-judae, and other polysaccharides containing (1 goes to 3)-glycosidic linkages.

Misaki A, Kakuta M, Sasaki T, Tanaka M, Miyaji H

Antitumor activities of two (1 goes to 3)-beta-D-glucans, isolated from the fruiting body of Auricularia auricula-judae ("kikurage", an edible mushroom), and other branched polysaccharides containing a backbone chain of (1 goes to 2)-alpha-D-glucosidic or (1 goes to 3)-alpha-D-mannosidic linkage [and their corresponding (1 goes to 3)-D-glycans, derived by mild, Smith degradation] were compared. Among these polysaccharides, a water-soluble, branched (1 goes to 3)-beta-D-glucan (glucan I) of A. auricula-judae exhibited potent, inhibitory activity against implanted Sarcoma 180 solid tumor in mice. The alkali-insoluble, branched (1 goes to 3)-beta-D-glucan (glucan II), a major constituent of the fruiting body, showed essentially no inhibitory activity. When the latter glucan, having numerous branches attached, was modified by controlled, periodate oxidation, borohydride reduction, and mild, acid hydrolysis, the resulting, water-soluble, regraded glucan, having covalently linked polyhydroxy groups attached at O-6 of the (1 goes to 3)-linked D-glucosyl residues, exhibited potent antitumor activity. Further investigations using the glucan-polyalcohol indicated that the attachment of the polyhydroxy groups to the (1 goes to 3)-beta-D-glucan backbone may enhance the antitumor potency of the glucan. On the other hand, partial introduction of carboxymethyl groups into glucan II (d.s., 0.47--0.86), which altered the insolubility property, failed to enhance the antitumor activity. The interrelation between the antitumor activity and the structure of the branched (1 goes to 3)-beta-D-glucan is discussed, on the basis of methylation and 13C-n.m.r. studies of the periodate-modified glucans.

PMID: 7196285, UI: 81258504

Mycologia 1967 Sep;**59(5):**803-818

Micro-evolution in Auricularia auricula.

Duncan EG, Macdonald JA

PMID: 6070538, UI: 68082222

83 citations found

J Invertebr Pathol 1997 Nov;**70(3):**203-208

Isolation, Inoculation to Insect Host, and Molecular Phylogeny of an Entomogenous Fungus Paecilomyces tenuipes.

Fukatsu T, Sato H, Kuriyama H

[Record supplied by publisher]

A parasitic fungus to moth larvae and pupae, Paecilomyces tenuipes, was isolated and cultured on liquid and agar media. Fruit bodies, or synnemata, with characteristics of P. tenuipes were successfully formed on the agar medium. When pupae of wax moth, Galleria mellonella, were incubated with the conidia, all the pupae were infected and the synnemata were formed out of them. Almost the entire length of 18S rDNA of P. tenuipes was amplified by PCR and directly sequenced. Molecular phylogenetic analysis demonstrated that it belongs to the subphylum Ascomycotina, the class Pyrenomycetes, the order Clavicipitales. This result is compatible with the suggestions that P. tenuipes may be the anamorph of an entomogenous fungus of the genus Cordyceps.

PMID: 9367727

Lett Appl Microbiol 1997 Oct;**25(4):**239-242

The determination of the partial 18 S ribosomal DNA sequences of Cordyceps species.

Ito Y, Hirano T

[Medline record in process]

Cordyceps species, which are used in Chinese traditional medicines, are fungal parasites of insects. In this study the partial nucleotide sequences of 18 S ribosomal DNA from four Cordyceps species were determined and compared with the sequences of published ascomycetes. The sequence data support the concept that Cordyceps species belong to the pyrenomycetes. Based on sequence data the phylogenetic tree was constructed using the neighbor-joining (NJ) method. Diversity in the phylogenetic tree was found for Cordyceps species. A new classification of Cordyceps species can be constructed based on the phylogenetic information obtained from such rDNA sequences.

PMID: 9351269, UI: 98012554

Life Sci 1997;**60(25):**2349-2359

Effect of Cordyceps sinensis on the proliferation and differentiation of human leukemic U937 cells.

Chen YJ, Shiao MS, Lee SS, Wang SY

Cordyceps sinensis is a herb medicine with antitumor activity capable of suppressing the growth of mouse Sarcoma 180 in vivo. In the present study, we have isolated polysaccharide fraction of Cordyceps sinensis (PSCS) and investigated its effect on the proliferation and differentiation of human leukemic U937 cells using an in vitro culture system. Our results showed that the conditioned medium from PSCS (10 microg/ml)-stimulated blood mononuclear cells (PSCS-MNC-CM) had an activity that could significantly inhibit the proliferation of U937 cells resulting in a growth inhibition rate of 78-83%. Furthermore, PSCS-MNC-CM treatment induced about 50% of the cells differentiating into mature monocytes/macrophages expressing nonspecific esterase (NSE) activity and the surface antigens of CD11b, CD14, and CD 68. Yet, the differentiated U937 cells also had functions of phagocytosis and superoxide production. However, PSCS alone or normal MNC-CM had no such effects. The levels of interferon (IFN)-gamma, tumor necrosis factor (TNF)-alpha, and interleukin (IL)-1 were very low in normal MNC-CM, and they were greatly increased in MNC-CM prepared with PSCS stimulation. Antibody neutralization studies further revealed that the tumoricidal and differentiating effects of PSCS-MNC-CM were mainly derived from the elevated cytokines, especially IFN-gamma and TNF-alpha. These two cytokines acted synergistically on inhibiting cell growth and inducing differentiation of the target U937 cells.

PMID: 9194691, UI: 97338020

Sci Total Environ 1996 Apr 5;**182(1-3):**193-195

Lead poisoning caused by contaminated Cordyceps, a Chinese herbal medicine: two case reports.

Wu TN, Yang KC, Wang CM, Lai JS, Ko KN, Chang PY, Liou SH

Two cases of lead poisoning, caused by the Chinese herbal medicine Cordyceps, were reported to the Department of Health in a laboratory-based blood lead surveillance program. Such unusual cases of lead poisoning have not been previously reported. These two patients took Cordyceps herbal medicine for treatment of underlying diseases. Loss of appetite and anemic signs of lead poisoning were manifested in one patient with a blood lead level of 130 microg/dl, while the other patient was asymptomatic with a blood lead level of 46 microg/dl. The lead content in the Cordyceps powder was found to be as high as 20 000 ppm. After cessation of intake in the asymptomatic patient, and cessation of intake and treatment with chelating agents in the symptomatic patient, the blood lead levels returned to normal range. This report raises concerns about lead poisoning from unusual herbal medicine worldwide.

PMID: 8854946, UI: 97007687

Biol Pharm Bull 1996 Feb;**19(2):**294-296

Polysaccharides in fungi. XXXVI. Hypoglycemic activity of a polysaccharide (CS-F30) from the cultural mycelium of Cordyceps sinensis and its effect on glucose metabolism in mouse liver.

Kiho T, Yamane A, Hui J, Usui S, Ukai S

A polysaccharide (CS-F30) obtained from the cultural mycelium of Cordyceps sinensis showed potent hypoglycemic activity in genetic diabetic mice after intraperitoneal administration, and the plasma glucose level was quickly reduced in normal and streptozotocin-induced diabetic mice after intravenous administration. Administration of CS-F-30 to normal mice significantly increased the activities of hepatic glucokinase, hexokinase and glucose-6-phosphate dehydrogenase, although the glycogen content in the liver was reduced. Furthermore, CS-F30 lowered the plasma triglyceride level and cholesterol level in mice.

PMID: 8850325, UI: 97002986

Am J Chin Med 1996;**24(2):**111-125

Cordyceps sinensis as an immunomodulatory agent.

Kuo YC, Tsai WJ, Shiao MS, Chen CF, Lin CY

Effects of various fractions of methanol extracts from fruiting bodies of Cordyceps sinensis on the lymphoproliferative response, natural killer (NK) cell activity, and phytohemagglutinin (PHA) stimulated interleukin-2 (IL-2) and tumor necrosis factor-alpha (TNF-alpha) production on human mononuclear cells (HMNC) were studied. Two of the 15 column fractions (CS-36-39 and CS-48-51) significantly inhibited the blastogenesis response (IC50 = 71.0 +/- 3.0 and 21.7 +/- 2.0 micrograms/ml, respectively), NK cell activity (IC50 = 25.0 +/- 2.5 and 12.9 +/- 5.8 micrograms/ml, respectively) and IL-2 production of HMNC stimulated by PHA (IC50 = 9.6 +/- 2.3 and 5.5 +/- 1.6 micrograms/ml, respectively). TNF-alpha production in HMNC cultures was also blocked by CS-36-39 and CS-48-51 (IC50 = 2.7 +/- 1.0 and 12.5 +/- 3.8 micrograms/ml, respectively). These results indicated that neither CS-36-39 nor CS-48-51 was cytotoxic on HMNC, and that immunosuppressive ingredients are contained in Cordyceps sinensis.

PMID: 8874668, UI: 97028655

Jpn J Pharmacol 1996 Jan;**70(1):**85-88

Effects of the mycelial extract of cultured Cordyceps sinensis on in vivo hepatic energy metabolism in the mouse.

Manabe N, Sugimoto M, Azuma Y, Taketomo N, Yamashita A, Tsuboi H, Tsunoo A, Kinjo N, Nian-Lai H, Miyamoto H

Mice were given the extract of cultured Cordyceps sinensis (Cs) (200 mg/kg daily, p.o.) for 3 weeks. In vivo phosphorus-31 nuclear magnetic resonance (NMR) spectra of the liver were acquired at weekly intervals using a surface coil. From 1 to 3 weeks, a consistent increase in the ATP/inorganic phosphate ratio, which represents the high energy state, was observed in the Cs extract-treated mice. The intracellular pH of the Cs extract-treated mice was not significantly different from that of the control mice. No steatosis, necrosis, inflammation or fibrosis were observed in the liver specimens from Cs extract-treated mice.

PMID: 8822093, UI: 96419320

Chung Kuo Chung Yao Tsa Chih 1995 Dec;**20(12):**707-709

[Advances in the study on artificial cultivation of Cordyceps sinensis].

[Article in Chinese]

Yin D, Tang X

Publication Types:

- Review
- Review, tutorial

PMID: 8703330, UI: 96331894

Chung Kuo Chung Hsi I Chieh Ho Tsa Chih 1995 Aug;**15(8):**476-478

[Effect of Jinshuibao capsule on the immunological function of 36 patients with advanced cancer].

[Article in Chinese]

Zhou DH, Lin LZ

Jinshuibao Capsule (JSBC), produced by Jiangxi Jinshuibao pharmaceutical Company Limited, possesses the similar active principles and pharmacological activity with those of Cordyceps sinensis. The effect of JSBC on the immunological function of 36 patients with advanced cancer showed that it could restore cellular immunological function, improve quality of life, but had no significant effect on humoral immunological function. The results suggested that JSBC could be used as adjuvant drug in advanced cancer.

Publication Types:

- Clinical trial

PMID: 8580695, UI: 96147902

Chung Kuo Chung Hsi I Chieh Ho Tsa Chih 1995 Apr;**15(4):**255-256

[Current status of pharmacological study on Cordyceps sinensis and Cordyceps hyphae].

[Article in Chinese]

Wang ZX, Wang XM, Wang TZ

Publication Types:

- Review
- Review, tutorial

PMID: 7647550, UI: 95375525

Nephrol Dial Transplant 1995;**10(1):**142-143

Amelioration of cyclosporin nephrotoxicity by Cordyceps sinensis in

kidney-transplanted recipients.

Xu F, Huang JB, Jiang L, Xu J, Mi J

Publication Types:

- Letter

PMID: 7724020, UI: 95240916

J Antibiot (Tokyo) 1994 Sep;**47(9):**1010-1016

Comparison of balanol from Verticillium balanoides and ophiocordin from Cordyceps ophioglossoides.

Boros C, Hamilton SM, Katz B, Kulanthaivel P

Recently, we reported the isolation of the potent protein kinase C inhibitor balanol (1) from the fungus Verticillium balanoides. In an earlier study, Konig et al. reported the isolation of ophiocordin (3), a structural isomer of 1, from the fungus Cordyceps ophioglossoides. The present study was designed to clarify whether or not balanol and ophiocordin are different compounds. The results indicated that the two fungi produced the same compound, the structure being that assigned to balanol. In addition, a thirty-fold increase in the production of balanol from V. balanoides was observed when the culture medium was changed from cornmeal/tomato paste to soy meal/glycerol.

PMID: 7928689, UI: 95013719

Chung Kuo Chung Hsi I Chieh Ho Tsa Chih 1994 May;**14(5):**271-273

[Amelioration of aminoglycoside nephrotoxicity by Cordyceps sinensis in old patients].

[Article in Chinese]

Bao ZD, Wu ZG, Zheng F

The protective effect on aminoglycoside nephrotoxicity by Cordyceps sinensis in the old patient was observed. 21 old patients were randomly divided into two groups. Each group received amikacin sulfate for 6 days. In addition, group A was administered Cordyceps sinensis for 7 days and group B was given placebo. The results revealed that group A developed less prominent nephrotoxicity compared with group B as evidenced by less urinary nephro-aminoglycosidase (NAGase) and beta-microglobulin in group A than those in Group B. These results suggested that Cordyceps sinensis exerted a protective effect on aminoglycoside nephrotoxicity in the old patients.

Publication Types:

- Clinical trial
- Randomized controlled trial

PMID: 7950209, UI: 95037531

Cancer Invest 1994;**12(6):**611-615

Growth inhibitors against tumor cells in Cordyceps sinensis other than cordycepin and polysaccharides.

Kuo YC, Lin CY, Tsai WJ, Wu CL, Chen CF, Shiao MS

Cordyceps sinensis is a parasitic fungus that has been used as a Chinese medicine for a long time. In the present study, inhibitory effects of crude methanolic extracts of C. sinensis fruiting bodies on various tumor cell lines were demonstrated. The crude methanolic extracts were fractionated into 15 fractions by silica gel column chromatography. Two of the 15 fractions (CS-36-39 and CS-48-51) significantly inhibited the growth of K562, Vero, Wish, Calu-1, and Raji tumor cell lines. The inhibitory activities were not due to the polysaccharides, which have been removed in the extracting process. The polarities of these two fractions indicated that they were different from that of cordycepin. Therefore, it is suggested that tumor cell growth inhibitors, other than cordycepin and polysaccharides, are contained in C. sinensis.

PMID: 7994596, UI: 95086884

Biol Pharm Bull 1993 Dec;**16(12):**1291-1293

Polysaccharides in fungi. XXXII. Hypoglycemic activity and chemical properties of a polysaccharide from the cultural mycelium of Cordyceps sinensis.

Kiho T, Hui J, Yamane A, Ukai S

Crude polysaccharides were obtained from a hot-water extract and alkaline extracts of the cultural mycelium of Cordyceps sinensis. They showed significant activity in normal mice and streptozotocin-induced diabetic mice as a result of intraperitoneal (i.p.) injection. A crude polysaccharide (CS-OHEP) obtained from 5% sodium hydroxide extract slightly lowered the plasma glucose level in normal mice by oral (p.o.) administration. A neutral polysaccharide (CS-F30) exhibited higher hypoglycemic activity than its crude polysaccharide (CS-OHEP), exhibited by i.p. injection, and it significantly lowered the glucose level by p.o. administration (50 mg/kg). However, it hardly affected the plasma insulin level in normal mice. CS-F30 ([alpha]D + 21 degrees in water) is composed of galactose, glucose and mannose (molar percent, 62:28:10), and its molecular weight is about 45000.

PMID: 8130781, UI: 94177158

J Tradit Chin Med 1993 Sep;**13(3):**223-226

Recent advances in studies on traditional Chinese anti-aging materia medica.

Chen K, Li C

Presented in this paper is a report of our studies on 386 traditional effective anti-aging medications, the effects of which on cell generation, survival time, immunomodulation, improvement of visceral and metabolic functions, and anti-infection, and their trace element contents were further summarized and analysed. This suggests that the investigations of traditional anti-aging materia medica in China are now well under way and some effective drugs

and compound prescriptions have been explored, such as Ginseng, Radix Astragali seu Hedysari, Radix Angelicae Sinensis, Herba Epimedii, Cordyceps, Ganoderma Lucidum seu Japonicum, Radix Polygoni Multiflori, Radix Acanthopanacis Senticosi, Rhizoma Polygonati, Fructus Lycii, and Poria. However, all of these preliminary results remain to be further investigated.

Publication Types:

- Review
- Review, tutorial

PMID: 8246603, UI: 94066555

Chung Hua I Hsueh Tsa Chih 1993 Jul;**73(7):**410-412

[Cordyceps sinensis in protection of the kidney from cyclosporine A nephrotoxicity].

[Article in Chinese]

Zhao X, Li L

To explore the protective effect of cordyceps sinensis (CS) on cyclosporine A nephro-toxicity (CsA-Nx) and the possible mechanism, we studied the kidney changes induced by CsA in rats by light microscopy (LM), electronic microscopy (EM) and morphometrical analysis. At the 15th day after receiving CsA, prominent vacuolation and necrosis were noted microscopically in proximal tubular cells and mitochondria swelling electronmicroscopically. Morphometrical study showed that the epithelial areas of both proximal and distal tubules in the CS group were larger than those of the control group. There were obvious vacuolation (90%) and necrosis in proximal tubular cells at different stages of chronic CsA-Nx. Interstitial edema with mild fibrosis was observed. Mitochondria abnormality was seen electronmicroscopically. Morphometrical analysis showed that the epithelial cell areas of tubules and glomeruli were smaller in the CsA group than those in the CS group. Both acute and chronic experiments showed that CS could protect the kidney from CsA-Nx and ameliorate the glomerular and interstitial injuries.

PMID: 8293343, UI: 94123156

Chin Med J (Engl) 1993 Apr;**106(4):**313-316

Effect of Cordyceps sinensis on erythropoiesis in mouse bone marrow.

Li Y, Chen GZ, Jiang DZ

The effect of Cordyceps sinensis crystal (CS-Cr) on stimulating proliferation of erythroid progenitor cells (CFU-E and BFU-E) in LACA mouse marrow in vivo and in vitro by methyl cellulose gel culture system is reported. The numbers of CFU-E and BFU-E were increased after 5 consecutive daily treatment with 100, 150 and 200 mg/kg of CS-Cr with a peak at 150 mg/kg. Higher doses (> 150 mg/kg) of CS-Cr resulted in a reduction of the peak of CFU-E and BFU-E and then, the numbers returned to the control level with increased doses. The cytosine arabinoside (Ara-C) suicide test showed significant increases in the percentage of CFU-E and BFU-E in S-phase after CS-Cr treatment. Pretreatment of mice with CS-Cr could protect CFU-E and BFU-E against the cytotoxic agent--harringtonine. Addition of CS-Cr to culture system also promoted the generation of CFU-E and BFU-E at concentrations of 150-200 micrograms/ml in vitro. With a liquid culture technique, a stimulatory action of CS-Cr on fibroblast colony-forming units (CFU-F) proliferation was seen in vivo and in vitro.

PMID: 8325161, UI: 93314403

Chung Kuo Chung Yao Tsa Chih 1993 Feb;**18(2):**80-82

[Relationship between illumination and growth of the stroma of Cordyceps sinensis (Berk.) Sacc].

[Article in Chinese]

Li L, Yin DH, Tang CH, Fu SQ

The growth of the stroma of Cordyceps sinensis largely depends upon the illumination in its growth period. By increasing illumination time and light intensity, its growth height can be controlled, growth rate slowed down and the corrosion time of larva body of host insect prolonged. Ultraviolet light is able to affect the growth of stroma too. The stroma also shows the strong phototaxis in its growth period. The arrangement and formation of the perithecium vary with the illumination.

PMID: 8323702, UI: 93312495

Am J Chin Med 1993;**21(3-4):**257-262

The effects of Chinese herbs on improving survival and inhibiting anti-ds DNA antibody production in lupus mice.

Chen JR, Yen JH, Lin CC, Tsai WJ, Liu WJ, Tsai JJ, Lin SF, Liu HW

Systemic lupus erythematosus (SLE) is an important autoimmune disease with multiple organ system involvement. From preliminary studies, we have found that six Chinese herbs: Atractylodes ovata, Anqelica sinensis, Cordyceps sinensis, Liqustrum lucidum, Codonopsis pilosula and Homo sapiens can improve defective in vitro interleukin-2 (IL-2) production in patients with SLE. In order to investigate the in vivo effects of these herbs, we used NZB/NZW F1 mice, a typical lupus animal model used to test these herbs. It was found that C. pilosula, H. sapiens and C. sinensis could prolong the life span of female NZB/NZW F1 mice and inhibited anti-ds DNA production. Although A. sinensis could prolong the life span of experimental mice, it did not inhibit the production of anti-ds DNA antibody. These herbs may have great potential for the management of human SLE in the future.

PMID: 8135170, UI: 94182521

Chung Kuo Chung Hsi I Chieh Ho Tsa Chih 1992 Jun;**12(6):**338-339

[Effect of Cordyceps sinesis on T-lymphocyte subsets in chronic renal failure].

[Article in Chinese]

Guan YJ, Hu Z, Hou M

Synchronous measurements of renal function and T-cell subsets were taken in 51 cases of chronic renal failure (CRF) patients. Cordyceps sinesis 3-5 g/d was given to 28 out of these 51 patients, which was considered as

follow-up group. The results were stated as follows: (1) Obvious decrease of OKT3, OKT4, OKT4/OKT8 was found in CRF ($P < 0.01$). (2) OKT4 and OKT4/OKT8 were proportional to plasma albumin and Hb levels ($P < 0.05$). (3) After administration of Cordyceps sinesis, improvement of renal function and OKT4, OKT4/OKT8 were confirmed. This study indicated that cellular immune function was decreased in CRF. Administration of Cordyceps sinesis might improve their renal function and as the same time enhance the cellular immune function in CRF.

PMID: 1421972, UI: 93044105

Chung Kuo Chung Yao Tsa Chih 1992 Jun;**17(6):**364-366

[Pharmacological study on Cordyceps sinensis (Berk.) Sacc. and ze-e Cordyceps].

[Article in Chinese]

Lei J, Chen J, Guo C

The Ze-e Cordyceps is similar to the Cordyceps sinensis in such pharmacological actions as calming, enduring hypoxia, dilating trachea, male sex hormone action, antiphlogistic and toxicity, etc. It is thus suggested that the Ze-e Cordyceps may be used place of the Cordyceps sinensis in clinical practice.

PMID: 1418585, UI: 93039626

Chung Kuo Chung Hsi I Chieh Ho Tsa Chih 1992 May;**12(5):**267-269

[Effects of Cordyceps sinensis (CS) on in vitro natural killer cells].

[Article in Chinese]

Liu C, Lu S, Ji MR

The effect of Cordyceps sinensis (CS) on peripheral NK cells from healthy persons and leukemia patients were studied. The results showed that CS could argument the NK cell activity, meanwhile, the dose-dependent effect was found within the range of dosage adopted ($r = 0.984$, P less than 0.01; $r = 0.988$, P less than 0.01). Furthermore, CS could also improve the CD16 marker expression on lymphocytes and the binding capacity to K562 cells. Cytotoxicity could not present when the PBNCs were co-incubated with CS. These results suggested that CS could be exploited and utilized as an approach of biological responsive modifier therapy (BRMT) in the treatment of leukemia.

PMID: 1392475, UI: 93005449

Chung Kuo Chung Hsi I Chieh Ho Tsa Chih 1992 May;**12(5):**288-291

[Mechanisms and therapeutic effect of Cordyceps sinensis (CS) on aminoglycoside induced acute renal failure (ARF) in rats].

[Article in Chinese]

Zhen F, Tian J, Li LS

Nephrotoxic ARF model of rat was induced by IP injection of either Gentamycin or Kanamycin and treated with CS. The results of study showed that the simultaneous administration of CS with Gentamycin could protect the proximal tubular cells from Gentamycin toxicity and the use of CS after the establishment of Kanamycin nephrotoxic ARF could prompt an earlier recovery from ARF as compared with the control group. The possible mechanisms of CS on ARF include: (1) protecting tubular cell sodium pump activity; (2) attenuating tubular cell lysosome overfunction stimulated by phagocytosis of aminoglycoside; (3) decreasing tubular cell lipoperoxidation in response to toxic injury.

PMID: 1327329, UI: 93005456

Chung Kuo Chung Hsi I Chieh Ho Tsa Chih 1992 Apr;**12(4):**207-209

[Modulating effects of extractum semen Persicae and cultivated Cordyceps hyphae on immuno-dysfunction of inpatients with posthepatitic cirrhosis].

[Article in Chinese]

Zhu JL, Liu C

The treatment of 65 cases (with 20 cases in the control group) of patients with post-hepatic cirrhosis by Extractum Semen Persicae (ESP) and cultivated Cordyceps Hyphae (CH) was reported, and the adjustment of the disorders of both cellular and humoral immune functions was investigated. The results indicated apparently that the restrained cellular immune function, among which the rate of lymphocyte transformation, the NK cell's function, CD8+ and CD4+ cells in the patients' group were lower than those in the healthy group. The CD8+ cell count was positively correlated with lymphocyte transformation rate and the humoral immune hyperfunction revealing that the levels of IgG, IgA, ssIgA and CIC of the patients were abnormally higher than those of healthy subjects, while level of C3 was negatively correlated with that of CIC. After the treatment, rate of transformation, function of NK cell, CD8+, CD4+ cells and the ratio of CD4+/CD8+ improved; levels of IgG, IgA, ssIgA and CIC reduced, while those of C4 and C3 rose. These results revealed the ESP and cultivated CH could modulate the cellular immune function, inhibit the humoral immune hyperfunction and increase serum complement level in patients with post-hepatitic cirrhosis, which were correlated to the improvement of hepatic function. Disorder of immune function was one of the important causes of liver cell necrosis, inflammatory cell infiltration and fibroplastic proliferation. The results showed that the drugs are of some value in the treatment of patients with post-hepatitic cirrhosis.

PMID: 1498539, UI: 92361116

Chin Med J (Engl) 1992 Feb;**105(2):**97-101

Effects of cordyceps sinensis on natural killer activity and colony formation of B16 melanoma.

Xu RH, Peng XE, Chen GZ, Chen GL

This paper reports the study on the effects of the ethanol extract of Cordyceps sinensis (CS-II), a potent herbal tonic, on murine and human in vitro natural killer cell (NK) activities and on murine in vivo NK activity (by 125I clearance assay), and on colony formation of B16 melanoma in mouse lungs. The results revealed that: 1. the in vivo and in vitro NK activities of mouse were both significantly augmented by intraperitoneal (ip) injection of CS-II. Besides, the inhibition of mouse NK activity by cyclophosphamide (Cy) was prevented following the

administration of CS-II; 2. the in vitro NK activity of human peripheral blood mononuclear cells (PBMs) was elevated by preincubation of PBMs with CS-II; and 3. the colony formation of B16 melanoma in mouse lungs was reduced significantly by ip pretreatment of the mice with CS-II. This study indicates that CS-II may be used as an immunopotentiating agent in treating cancer and immunodeficient patients.

PMID: 1597083, UI: 92282954

Chung Kuo Chung Yao Tsa Chih 1992 Jan;**17(1):**14-15

[Influence of external conditions of the occurrence of sexual stage in Cordyceps].

[Article in Chinese]

Wang W, Liu X, Chen J

Experiments have been carried out on fruiting the dead larva of Napialus hunanensis infected with Cordyceps hawkesii in nature, under alternating temperatures, humidity preservation and adequate illumination. The results show that the occurrence of sexual state from the dead larva can be induced normally by providing suitable external conditions.

PMID: 1524658, UI: 92398755

Chung Hua I Hsueh Tsa Chih (Taipei) 1992 Jan;**72(1):**27-29

[Effect of cordyceps sinensis on cellular immunity in rats with chronic renal insufficiency].

[Article in Chinese]

Cheng Q

Animal model of chronic renal failure (CRF) was induced in wistar rats by 5/6 nephrectomy. Half of the rats were treated with Cordyceps sinensis (CS) in form of decoction. It was found that CS has mitogenic effect on spleen lymphocytes, and is capable of increasing the production of IL-2 from splenocytes of the CRF rats. IL-2 absorbency of the splenocytes was promoted by CS. CS also exhibited such therapeutic effects on CRF animal as to decrease the level of BUN and serum creatinine and to increase the level of hemoglobin. These results indicate that CS has a regulative effect on cellular immunity in CRF rats.

PMID: 1315612, UI: 92248481

Chung Hua I Hsueh Tsa Chih (Taipei) 1991 Nov;**71(11):**612-615

[Inhibitory effects of alcoholic extract of Cordyceps sinensis on abdominal aortic thrombus formation in rabbits].

[Article in Chinese]

Zhao Y

Aortic thrombosis in de-endotheliazed rabbit and 51Cr labeled autologous platelets were used for the evaluation of in vivo effects of CsB-851 on platelet-vessel wall interaction. The result showed that when CsB-851, an active part of alcoholic extract of mycelium from Cordyceps sinensis (Berk.) Sacc., was infused intravenously, the 51Cr labeled platelet number per gram dry weight of injured abdominal aorta (98.14 +/- 9.41 x 10(6)) was much lower than that in the control group (201.25 +/- 27.21 x 10(6)) in a concentration dependent manner. This indicated that CsB-851 could inhibit thrombus formation at the de-endotheliazed surface of the aorta. Since it could inhibit platelet aggregation in vitro had no effect on coagulation function in vivo, it seemed that the inhibitory effect of CsB-851 on arterial thrombus formation was mainly related to the inhibition of platelet functions.

PMID: 1666972, UI: 92224031

Chung Hsi I Chieh Ho Tsa Chih 1991 Sep;**11(9):**547-549

[Effects of Cordyceps sinensis, rhubarb and serum renotropin on tubular epithelial cell growth].

[Article in Chinese]

Tian J, Chen XM, Li LS

Primary cultured rat tubular epithelium was utilized to investigate the effect of Cordyceps sinensis (CS) on cellular proliferation and metabolism. Judging from incorporation rate of 3H-TdR, it was found that the addition of serum containing CS metabolites into the culture media could promote the DNA synthesis of tubular cells profoundly (P less than 0.001). In association with its beneficial effects on gentamycin nephrotoxity in vivo study, it is indicated that CS could enhance the regeneration of injured tubular cells. In addition, sera obtained from 5/6 nephrectomized rats (5/6 NT) and rhubarb treated rats were studied to see their effects on tubular cells growth. The results showed that the serum of 5/6 NT rats could promote the DNA synthesis of tubular epithelium, while the presence of experimental serum of rhubarb in culture median markedly inhibited the DNA synthesis of cells.

PMID: 1773472, UI: 92127664

Yakugaku Zasshi 1991 Sep;**111(9):**504-509

[Physiologically active compounds in the extracts from tochukaso and cultured mycelia of Cordyceps and Isaria].

[Article in Japanese]

Ikumoto T, Sasaki S, Namba H, Toyama R, Moritoki H, Mouri T

Tochukaso is a Chinese traditional medicine composed of a fruit body of Cordyceps sinensis and its parasitic host larva. Tochukaso (C. sinensis) and the cultured mycelia of five species of Cordyceps and four species of Isaria were each extracted with hot water and examined for the inotropic effect on guinea-pig right atrium in vitro system. The extracts from C. militaris and I. felina showed a negative inotropic effect to approximately the same extent as that from Tochukaso. These three extracts also showed inhibitory action on twitch response of guinea-pig ileum and aggregation of human blood platelet. It is suggested that these activities are ascribed to the combination of adenosine, 5'-adenosine monophosphate and several other nucleic acid-related compounds, all of which have been shown to be present in the extracts.

PMID: 1762052, UI: 92106193

Chung Kuo Chung Yao Tsa Chih 1991 Apr;**16(4):**240-242

[Anti-oxidation of Paecilomyces Sinensis].

[Article in Chinese]

Liu Y, Wu C, Li C

This paper indicates that Paecilomyces sinensis ig 3g/kg/dx14 increases the amount of superoxide dismutase in the liver tissues of mice; that Paecilomyces sinensis is similar to natural Cordyceps sinensis in inhibiting the production of Lpo and increasing the amount of superoxide dismutase in the liver homogenates of mice in vitro. In addition Paecilomyces sinensis can also increase the amount of glutathione peroxidase in the liver homogenates of mice in vitro.

PMID: 1863337, UI: 91321711

Yao Hsueh Hsueh Pao 1991;**26(5):**326-330

[A pharmacological analysis of the amino acid components of Cordyceps sinensis Sacc].

[Article in Chinese]

Zhang SS, Zhang DS, Zhu TJ, Chen XY

An artificial complex of amino acids (C I) was made by mixing 18 synthetic amino acids, according to the kinds and contents the amino acid contained in the natural Cordyceps sinensis Sacc., It showed the same sedative action as the natural C. sinensis, as indicated by the spontaneous activity inhibition in mice (photocell method). However, the action of commercial complex amino acid injection (12 X, total amino acid components are similar to C I) was more attenuated than that of C I. Comparing amino acid components of 12 X with C I, the latter was found to contain 5 times as much glutamic acid, tryptophan and tyrosine as those of 12 X. Another artificial amino acid complex (C II) consisting of the above mentioned 3 amino acids, also showed the same sedative action. This suggests that tryptophan is the principal component by orthogonal test. However, C II did not enhance the phagocytic action of mononucleophagocyte as the natural C. Sinensis did in the clear rate test of carbon granule from mice serum.

PMID: 1957681, UI: 92067537

Chin Med J (Engl) 1991 Jan;**104(1):**4-8

Effects of Cordyceps sinensis on murine T lymphocyte subsets.

Chen GZ, Chen GL, Sun T, Hsieh GC, Henshall JM

It was shown by flow cytometry analysis that crystalized preparation of Cordyceps sinensis (Cs-Cr) caused significant elevation of the number of T helper cells and Lyt-1/Lyt-2 (T helper to T suppressor cell) ratio both in peripheral blood and the treated mice spleen. The spleen weight, phagocyte counts and phagocytic activity were

also elevated in the treated group. In addition, Cs-Cr could protect T helper cells from the immunosuppressive effects of prednisolone acetate and cyclophosphamide. These results further substantiate the fact that Cs-Cr is an immunoregulator/biological response modifier of cellular immunity and may be potentially useful in handling immunodeficient or immunosuppressed patients.

PMID: 1831743, UI: 91347715

Yao Hsueh Hsueh Pao 1991;**26(10):**768-771

[Determination of ergosterol in Cordyceps sinensis and Cordyceps black-bone chicken capsules by HPLC].

[Article in Chinese]

Li YH, Li XL

A high performance liquid chromatographic method (HPLC) was developed for the determination of ergosterol in Cordyceps sinensis and Cordyceps black-bone chicken capsules. The sample was mixed with 0.5 ml of saturated KOH solution and 5 ml of ethanol, and refluxed for 1 h. The saponified mixture was diluted with 5 ml of 10% NACl solution and extracted 3 times with 5 ml portions of cyclohexane. The cyclohexane extracts were purified by partition column and concentrated by adsorption column and then analysed by HPLC. The other components of the Cordyceps black-bone chicken capsules have no interference to the determination of ergosterol. The proposed method is rapid, precise, accurate and sensitive. The whole process can be done in 2 h.

PMID: 1823719, UI: 92384058

Chung Hsi I Chieh Ho Tsa Chih 1990 Sep;**10(9):**570-571

[Immunopharmacological effect of Cordyceps sinensis].

[Article in Chinese]

Zhang H

Publication Types:

- Review
- Review, tutorial

PMID: 2268946, UI: 91098761

Chung Hsi I Chieh Ho Tsa Chih 1990 Aug;**10(8):**485-487

[Immunosuppressive effect of cultured Cordyceps sinensis on cellular immune response].

[Article in Chinese]

Zhu XY, Yu HY

The immunosuppressive effect of cultured Cordyceps sinensis (Bei Lin Capsule) was studied in vitro and in vivo. When the drug was added from 0.6 mg/ml to 5 mg/ml a significant dose-dependent inhibition effect was shown in the following immune reactions of mice (P less than 0.05-0.01): phagocytic function of peripheral blood leucocytes assayed by chemiluminescence; mitogenic response of spleen lymphocytes to Con A; mixed lymphocyte culture and LPS induced interleukin-1 release of macrophages. The survival rate of mice spleen lymphocytes cultured with Cordyceps sinensis 5 mg/ml in 37 degrees C 5% CO2 for 5 days was more than 80%. Cordyceps sinensis 4 g/kg daily significantly prolonged the mice skin allograft survival time (12.7 +/- 2.2 days v.s. 8.3 +/- 0.7 days in the control, P less than 0.01) and its immunosuppressive effect was close to that of Cyclosporin A 5 mg/kg daily on skin allograft.

PMID: 2208437, UI: 91004434

Yakugaku Zasshi 1990 Apr;**110(4):**286-288

[Polysaccharides in fungi. XXV. Biological activities of two galactomannans from the insect-body portion of Chan hua].

[Article in Japanese]

Kiho T, Nagai K, Miyamoto I, Watanabe T, Ukai S

Biological activities of two galactomannans (CI-P and CI-A) isolated from the insectbody portion of Chan hua (fungus: Cordyceps cicadae) were studied. CI-P having low affinity for concanavalin A (Con A) exhibited potent carbon-clearance activity in mouse, although both polysaccharides had little antitumor activity against sarcoma 180 in mice. Furthermore, CI-P and CI-A was found to have potent hypoglycemic activity in normal mice, and CI-A having high affinity for Con A showed slightly higher activity than CI-P.

PMID: 2376822, UI: 90331134

J Tongji Med Univ 1990;**10(2):**100-103

Cordyceps Sinensis-I as an immunosuppressant in heterotopic heart allograft model in rats.

Zhang Z, Xia SS

To investigate the inhibitory effects of Cordyceps Sinensis-I (CS-1) on the immune response responsible for the organ transplant rejection, we studied its effects of prolonging heterotopic heart allograft survival on rat model with heart graft; the effects of CS-1 were compared with those of cyclosporine A and glucocorticoid, and the possible pathological changes caused by CS-1 were observed. Our results showed that CS-1 can prolong the survival of grafted heart without causing infection, and it did not exert detrimental effects on vital organs. As a result, it proves to be a promising immunosuppressant in clinical organ transplantation in the future.

PMID: 2213952, UI: 91012690

Biotherapy 1990;**2(3):**199-205

Augmentation of various immune reactivities of tumor-bearing hosts with an extract of Cordyceps sinensis.

Yamaguchi N, Yoshida J, Ren LJ, Chen H, Miyazawa Y, Fujii Y, Huang YX, Takamura S, Suzuki S, Koshimura S, et al

In order to enhance general reactivity of immune system in the tumor-bearing host, we employed extract of Cordyceps sinensis (CSE) as a biological response modifier. Cordyceps sinensis is an interesting material produced by a kind of mushroom parasitic to larval moths and was used to hasten recovery from exhaustion in ancient China. In this experiment, C57BL/6 mice implanted subcutaneously with syngeneic EL-4 lymphoma cells were employed as the host. Oral administration of the extract leads to a reduction of tumor size and prolongation of the host survival time. As judged by plaque-forming cells against T-dependent (sheep erythrocytes) and T-independent (bacterial lipopolysaccharide) antigens, CSE showed to augment the antibody responses. As for the activities of peritoneal macrophages, chemotaxis was dramatically depressed within a few days after EL-4 transplantation up to the end of life, but treatment with CSE at -14, -7, -4, +4, +7 and +10 days after the tumor transplantation augmented the activity about four times stronger than that of control. Phagocytic activity of macrophages was also decreased in tumor-bearing mice treated with cyclophosphamide (100 mg/kg) 3 and 5 days after tumor transplantation. But administration of CSE restored the activity to more than the normal level. The overall efficacy of CSE was tested with protective activity against systemic infection by Salmonella enteritides. The tumor-bearing mice receiving this medicine lived significantly longer than any other groups without CSE.

PMID: 2206772, UI: 91001364

Chung Kuo Chung Yao Tsa Chih 1990 Jan;**15(1):**53-55

[Short-term curative effect of cultured Cordyceps sinensis (Berk.) Sacc. Mycelia in chronic hepatitis B].

[Article in Chinese]

Zhou L, Yang W, Xu Y, Zhu Q, Ma Z, Zhu T, Ge X, Gao J

33 cases of chronic hepatitis B. patients treated with cultured Cordyceps sinensis mycelia have shown that the drug improves the liver function, promotes negative transfer HBsAg, and markedly helps to raise plasma albumin, resist high gamma globulin and to adjust body immunocompetence. It is therefore suggested that cultured Cordyceps sinensis mycelia may be used as a medicine for chronic hepatitis B. patients in adjusting protein metabolism and correcting inversion of albumin and globulin.

PMID: 1693509, UI: 90274841

Chung Kuo Chung Yao Tsa Chih 1989 Oct;**14(10):**616-618

[Antiarrhythmic effects of Cordyceps sinensis (Berk.) Sacc].

[Article in Chinese]

Mei QB, Tao JY, Gao SB, Xu GC, Chen LM, Su JK

The administration of 65% alcohol extracts of Cordyceps sinensis can counteract the arrhythmias induced by aconitine or BaCl2 in rats, and increase the tolerant dose of ouabain to produce the arrhythmias in guinea pigs. The drug can reduce the heart rate of anesthetic rats, decreasing the contractility of isolated papillary muscle or atria in guinea pigs, but showing no effect on the automatic rhythmicity and the functional refractory period of the atria.

PMID: 2597326, UI: 90088760

Chung Kuo Chung Yao Tsa Chih 1989 Oct;**14(10):**608-609

[Chemical constituents of Cordyceps mililaris (L.) Link].

[Article in Chinese]

Liu JM, Zhong YR, Yang Z, Cui SL, Wang FH

Six constituents were isolated from the hypha of Jinlin Cordyceps mililaris. The structures were determined to be beta-sitosterol, ergosterol, D-mannitol, daenine adenosine and cordycepin (3'-deopadenosine). Cordycepin, ergosterol, adenine were isolated for the first time from this hypha of Jinlin C. mililaris.

PMID: 2597325, UI: 90088758

Jpn J Exp Med 1989 Aug;**59(4):**157-161

Antitumor activity of an extract of Cordyceps sinensis (Berk.) Sacc. against murine tumor cell lines.

Yoshida J, Takamura S, Yamaguchi N, Ren LJ, Chen H, Koshimura S, Suzuki S

A warm water-extract (ECS) prepared from dried Cordyceps sinensis (Berk.) Sacc., a Chinese traditional medicine, was tested for antitumor activity in vivo and in vitro. Ehrlich ascites carcinoma cells (EAC), allogeneic to ICR mice and Meth A fibrosarcoma (Meth A), syngeneic to BALB/c mice were used as the target tumor cell lines. Mice were inoculated i.p. with 1 x 10(6) EAC or 1 x 10(5) Meth A on Day 0, and ECS or saline (control) was injected i.p. to the mice from Day 1 to Day 4. ECS-treatment increased the median survival time of the allogeneic mice inoculated with EAC to 316% of the control. Eight of the 10 ECS-treated mice survived on the 60th day (Day 60) after EAC implantation. ECS-treatment also increased the median survival time of the syngeneic mice inoculated with Meth A to 312% of the control. Half of the ECS-treated mice survived on Day 60. On the other hand, no cytotoxic effect of ECS was found on either EAC or Meth A in vitro. The antitumor effect of ECS seen in the allogeneic mice was significantly reduced when the mice received whole body X-irradiation (5 Gy) before EAC implantation. These results suggest that the antitumor effect of ECS may be mediated through its immunomodulating action.

PMID: 2601113, UI: 90096598

Chem Pharm Bull (Tokyo) 1989 May;**37(5):**1337-1340

The correlation between molecular weight and antitumor activity of galactosaminoglycan (CO-N) from Cordyceps ophioglossoides.

Ohmori T, Tamura K, Ohgane N, Nakamura T, Kawanishi G, Yamada H, Nomoto K

A galactosaminoglycan (CO-N) obtained by ultrasonication from a protein-bound polysaccharide SN-C, which was isolated from Cordyceps ophioglossoides culture, has a direct cytotoxicity against tumor cells (Ohmori et al., Chem. Pharm. Bull., 37, 1019 (1989). High performance liquid chromatographic analysis revealed that CO-N shows a broad molecular weight distribution with an average molecular weight of 33000. A potent antitumor activity of CO-N was observed in the higher-molecular-weight fraction on gel filtration, and the low-molecular-weight fraction below 6600 showed a weak activity. However, the depolymerized CO-N (ca. 5500) obtained by further ultrasonication of the original CO-N still retained the antitumor activity of CO-N against Ehrlich ascitic carcinoma

or MM46 solid mammary carcinoma.

PMID: 2630099, UI: 90200015

Chem Pharm Bull (Tokyo) 1989 Apr;**37(4):**1019-1022

Isolation of galactosaminoglycan moiety (CO-N) from protein-bound polysaccharide of Cordyceps ophioglossoides and its effects against murine tumors.

Ohmori T, Tamura K, Fukui K, Kawanishi G, Mitsuyama M, Nomoto K, Miyazaki T

A galactosaminoglycan moiety was obtained from an antitumor polysaccharide fraction (SN-C) isolated from Cordyceps ophioglossoides culture. SN-C was subjected to sonication, then a protein-bound galactosaminoglycan (CO-N) was isolated specifically by precipitation with 10% ammonium hydroxide. When given intraperitoneally to mice, CO-N inhibited the proliferation of sarcoma 180 cells inoculated into the peritoneal cavity and exhibited a marked life-prolonging effect against ascitic tumors such as Ehrlich carcinoma and IMC carcinoma. CO-N also showed an inhibitory effect against solid Ehrlich carcinoma when given intratumorally and significantly inhibited the growth of a syngeneic solid tumor (MM46 mammary carcinoma) upon intravenous administration at a low dose. CO-N showed a cytocidal effect against cultured cells of IMC and P388D1 in vitro. Flow cytometric analysis demonstrated that fluorescein isothiocyanate-CO-N binds to the surface of Ehrlich cells.

PMID: 2766404, UI: 89355068

Chung Kuo Chung Yao Tsa Chih 1989 Feb;**14(2):**31-33

[Component analysis of the extracellular polysaccharide from Mortierella hepiali Chen et Lu sp. nov].

[Article in Chinese]

Li XM, Dai RQ, Zhu Q

The extracellular polysaccharide from the filtrate of fungal fermentation of Mortierella hepiali, a fungus isolated from traditional Chinese crude drug Cordyceps sinesis, is made up of three sugar components, glucose, mannose and galactose, which are detected by paper and gas chromatography. Both molar ratio and contents of the polysaccharide are determined by the internal standard method.

PMID: 2506893, UI: 90000386

Chem Pharm Bull (Tokyo) 1988 Nov;**36(11):**4512-4518

Dissociation of a glucan fraction (CO-1) from protein-bound polysaccharide of Cordyceps ophioglossoides and analysis of its antitumor effect.

Ohmori T, Tamura K, Wakaiki A, Kawanishi G, Tsuru S, Yadomae T, Nomoto K

PMID: 3246019, UI: 89230609

Chem Pharm Bull (Tokyo) 1988 Nov;**36(11):**4505-4511

Component analysis of protein-bound polysaccharide (SN-C) from Cordyceps ophioglossoides and its effects on syngeneic murine tumors.

Ohmori T, Tamura K, Takaoka H, Sawai T, Kawanishi G, Yanahira S, Tsuru S, Nomoto K

PMID: 3246018, UI: 89230608

Chung Hsi I Chieh Ho Tsa Chih 1988 Jun;**8(6):**352-354

[Pharmacological actions of Cordyceps sinensis].

[Article in Chinese]

Bao TT, Wang GF, Yang JL

PMID: 3191555, UI: 89051936

Chung Yao Tung Pao 1988 Apr;**13(4):**44-46

[Influence of Cordyceps sinensis (Berk.) Sacc. and its cultured mycelia on murine platelets and immune organs after irradiation with 60Co gamma-rays].

[Article in Chinese]

Liu XP

PMID: 3197202, UI: 89063541

Chung Yao Tung Pao 1988 Apr;**13(4):**34-36

[Water-soluble constituents of Cordyceps sinenses (Berk.) Sacc.--the nucleosides].

[Article in Chinese]

Xu WH

PMID: 3197200, UI: 89063538

Chung Yao Tung Pao 1988 Mar;**13(3):**9-10

[Identification of Cordyceps (Fr.) Link from Guizhou].

[Article in Chinese]

Wu XL

PMID: 3409429, UI: 88311310

Chung Yao Tung Pao 1987 Dec;**12(12):**41-45

[Vasodilating effect of cultured Cordyceps sinensis (Berk) Sacc. mycelia in anesthetized dogs].

[Article in Chinese]

Feng MG, Zhou QG, Feng GH

PMID: 3446395, UI: 88184735

Chung Yao Tung Pao 1987 Nov;**12(11):**42-44

[Comparison of some pharmacological effects between Cordyceps sinensis (Berk). Sacc. and Cephalosporium sinensis Chen sp. nov].

[Article in Chinese]

Wang Q, Zhao Y

PMID: 3446384, UI: 88184723

Chung Yao Tung Pao 1987 Feb;**12(2):**53-54

[Lewis lung cancer of mice treated with Cordyceps sinensis and its artificial cultured mycelia].

[Article in Chinese]

Zhang SL

PMID: 2955943, UI: 87273715

Chung Yao Tung Pao 1987 Jan;**12(1):**47-49

[Platelet hemopoiesis and ultrastructure observations in mice treated with natural Cordyceps sinensis and its cultured mycelia].

[Article in Chinese]

Chen DM

PMID: 2954706, UI: 87244615

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pn J Cancer Res 1986 Dec;**77(12):**1256-1263

Antitumor activity of protein-bound polysaccharide from Cordyceps ophioglossoides in mice.

Ohmori T, Tamura K, Tsuru S, Nomoto K

The effects of protein-bound polysaccharide (SN-C) extracted from Cordyceps ophioglossoides on the growth of transplanted allogeneic and syngeneic murine tumors were studied. SN-C given by intraperitoneal administration suppressed the growth of sarcoma-180 transplanted subcutaneously in mice. Intraperitoneal administration of SN-C also caused a significant prolongation of the life span of ICR mice inoculated intraperitoneally with Ehrlich carcinoma, and C3H/He mice inoculated intraperitoneally with a syngeneic tumor (X-5563). SN-C showed a significant cytocidal effect on cultured tumor cells. SN-C did not affect delayed-type hypersensitivity (DTH) in normal mice, but restored the depressed capacity to raise DTH in tumor-bearing mice. These results suggested that SN-C may exert both direct and host-mediated antitumor effects.

PMID: 3102430, UI: 87136945

Biochem Biophys Res Commun 1986 Oct 15;**140(1):**350-356

Occurrence of Gal beta (1----3) GalNAc-Ser/Thr in the linkage region of polygalactosamine containing fungal glycoprotein from Cordyceps ophioglossoides.

Kawaguchi N, Ohmori T, Takeshita Y, Kawanishi G, Katayama S, Yamada H

The nitrous acid deamination liberated the N-acetyl galactosamine containing glycoproteins from galactosminoglycan (CO-N) which has been isolated from Cordyceps ophioglossoides culture. Mild alkaline borohydride degradation of the purified glycoprotein released oligosaccharide alditols. The smallest oligosaccharide alditol was characterized to be Gal beta (1----3)-GalNAcol. This result indicated that polygalactosamine part attached to protein part via Gal beta (1----3) GalNAc-Ser/Thr as the linkage region. To our knowledge, this is the first report of Gal-GalNAc-Ser/Thr linkage from fungal glycoprotein.

PMID: 3778454, UI: 87048768

Chung Yao Tung Pao 1986 Jul;**11(7):**51-54

[Antitumor activity of Cordyceps sinensis and cultured Cordyceps mycelia].

[Article in Chinese]

Du DJ

PMID: 2948710, UI: 87103232

Chung Yao Tung Pao 1986 Jan;**11(1):**13-14

[Bionomic environment of Cordyceps barnesii].

[Article in Chinese]

Ma XF

PMID: 2943452, UI: 86298689

Chung Yao Tung Pao 1985 Dec;**10(12):**3-5

[Cordyceps sinensis and cultured mycelia].

[Article in Chinese]

Sun YH

Publication Types:

- Review

PMID: 2940020, UI: 86218299

Chung Hsi I Chieh Ho Tsa Chih 1985 Nov;**5(11):**652-654

[Treatment of hyperlipidemia with cultivated Cordyceps--a double-blind, randomized placebo control trial].

[Article in Chinese]

Shao G

Publication Types:

- Clinical trial
- Randomized controlled trial

PMID: 2938807, UI: 86190161

Chung Hsi I Chieh Ho Tsa Chih 1985 Oct;**5(10):**622-624

[Immuno-pharmacologic activity of Cordyceps sinensis (Berk) Sacc].

[Article in Chinese]

Liu GT, Xu RL

PMID: 2938804, UI: 86190158

Chung Yao Tung Pao 1985 Mar;**10(3):**33-35

[Preliminary study of Cordyceps barnesii--comparison of the chemical constituents of Cordyceps barnesii and Cordyceps sinensis].

[Article in Chinese]

Guo YW

PMID: 2931200, UI: 86002554

Chung Hsi I Chieh Ho Tsa Chih 1985 Jan;**5(1):**45-47

[Activation of murine peritoneal macrophages by natural Cordyceps sinensis and its cultured mycelia].

[Article in Chinese]

Zhang SL

PMID: 3156684, UI: 85152243

Chung Hsi I Chieh Ho Tsa Chih 1985 Jan;**5(1):**42-44

[The effect of natural Cordyceps sinensis and its cultured mycelia on murine immuno-organs and function of the mononuclear macrophage system].

[Article in Chinese]

Chen DM

PMID: 3156683, UI: 85152242

Chung Hua Chung Liu Tsa Chih 1984 Sep;**6(5):**335-337

[Inhibitory effect of Cordyceps on carcinogenesis of the forestomach in mice].

[Article in Chinese]

Lin PZ

PMID: 6335987, UI: 85203377

Carbohydr Res 1984 Jan 10;**125(1):**107-115

Structure and antitumor activity of an alkali-soluble polysaccharide from Cordyceps ophioglossoides.

Yamada H, Kawaguchi N, Ohmori T, Takeshita Y, Taneya S, Miyazaki T

A water-insoluble extracellular glucan (CO-1) was isolated from the precipitate formed on incubation of the culture filtrate of Cordyceps ophioglossoides at 37 degrees for 19 h. CO-1 was homogeneous as judged by h.p.l.c., electrophoresis, and ultracentrifugation, and the average molecular weight was determined by h.p.l.c. to be 632,000. The 1H- and 13C-n.m.r. and the i.r. spectra indicated that the glucosidic linkages in CO-1 were beta. From the results of methylation analysis, Smith degradation, n.m.r. studies, and enzymic hydrolysis, it was concluded that CO-1 is composed of a backbone of (1----3)-linked beta-D-glucopyranosyl residues with a beta-D-glucopyranosyl group attached to O-6 of every second D-glucopyranosyl residue of the backbone. CO-1 strongly inhibited the growth of Sarcoma 180 solid-type tumor. CO-1 polyalcohol, which was prepared by Smith degradation of CO-1, exhibited more-potent antitumor activity than CO-1. The absorption maximum of Congo Red shifted significantly in the presence of CO-1.

PMID: 6704989, UI: 84156374

Chung Yao Tung Pao 1983 Sep;**8(5):**33-35

[Studies on immunological actions of Cordyceps sinensis. I. Effect on cellular immunity].

[Article in Chinese]

Chen YP

PMID: 6228335, UI: 84082377

Chung Yao Tung Pao 1983 Mar;**8(2):**32-33

[Studies on chemical constituents of Cordyceps sinensis I].

[Article in Chinese]

Xiao YQ

PMID: 6222810, UI: 83233023

Chem Pharm Bull (Tokyo) 1983 Feb;**31(2):**741-744

Polysaccharides in fungi. XIII. Antitumor activity of various polysaccharides isolated from Dictyophora indusiata, Ganoderma japonicum, Cordyceps cicadae, Auricularia auricula-judae, and Auricularia species.

Ukai S, Kiho T, Hara C, Morita M, Goto A, Imaizumi N, Hasegawa Y

PMID: 6883594, UI: 83285550

Arch Microbiol 1977 May 13;**113(1-2):**121-130

Ophiocordin, an antifungal antibiotic of Cordyceps ophioglossoides.

Kneifel H, Konig WA, Loeffler W, Muller R

An unknown antibiotic, ophiocordin, C21H22N2O8, MW: 430, was isolated from submerged cultures of Cordyceps ophioglossoides, strain TU 276, grown in a glycerol soybean meal medium at 27 degrees C. The antibiotic was extracted from acidified culture fluids with n-butanol and purified by subsequent column chromatography on DEAE-Sephadex and cellulose. Studies including nuclear magnetic resonance and mass spectrometry resulted in proposals of partial structures of the molecule. Inhibition by ophiocordin could be demonstrated for a small number of fungi belonging to different taxonomic groups. Bacteria were not inhibited. The antifungal effect was antagonized by ammonia and nitrate ions and by certain amino acids.

PMID: 560831, UI: 77241054

Biochim Biophys Acta 1976 Apr 2;**425(4):**532-536

Biosynthesis of 3'-deoxyadenosine by Cordyceps militaris. Mechanism of reduction.

Lennon MB, Suhadolnik RJ

The biosynthesis of 3'-deoxyadenosine (cordycepin) by Cordyceps militaris has been investigated using [U-14C]adenosine and [3-3H]ribose. Crystallization of the resulting radioactive 3'-deoxyadenosine to a constant specific activity showed incorporation of both labeled compounds. A control showed that the 3H:14C ratio of the AMP isolated from the RNA was the same as the 3H:14C ratio in the 3'-deoxyadenosine. The 14C ratio in the adenine: ribose of the [U-14C]adenosine added to the 3'-deoxyadenosine producing cultures of C. militaris and of the isolated 3'-deoxyadenosine was the same, e.g. 50:50. These data provide strong evidence that adenosine in converted to 3'-deoxyadenosine without hydrolysis of the N-riboside bond. Degradation of the 3-deoxyribose from 3'-deoxyadenosine showed that the 3H was retained on carbon-3. These results suggest that the formation of 3'-deoxyadenosine may proceed by a reductive mechanism similar to that for the formation of 2'-deoxynucleotides.

PMID: 1083247, UI: 76161264

Arch Biochem Biophys 1975 Sep;**170(1):**315-325

The presence in the fungus Cordyceps militaris of nuclear proteins

resembling histones.

Indik ZK, Keller BJ, Marks DB

PMID: 1164035, UI: 76017558

J Pharm Pharmacol 1972 Dec;**24(Suppl):**125P

Production of pure cordycepin (3'-deoxyadenosine) from Cordyceps militaris.

Melling J, Belton FC, Kitching D, Stones WR

PMID: 4144844, UI: 73169520

J Gen Microbiol 1971 Dec;**69(2):**253-259

Growth of unicellular forms of the fungus Cordyceps militaris and analysis of the chemical composition of their walls.

Marks DB, Keller BJ, Guarino AJ

PMID: 4947819, UI: 72166188

Biochim Biophys Acta 1969 Jun 17;**182(2):**307-315

Nucleoside antibiotics. IV. Metabolic fate of adenosine and cordycepin by Cordyceps militaris during cordycepin biosynthesis.

Chassy BM, Suhadolnik RJ

PMID: 4978604, UI: 69238112

Biochim Biophys Acta 1969 Jun 3;**183(1):**58-64

The composition of the cell wall fraction of the fungus, Cordyceps militaris.

Marks DB, Keller BJ, Guarino AJ

PMID: 5792874, UI: 69231681

Arch Pharm Ber Dtsch Pharm Ges 1968 Apr;**301(4):**291-294

[On the microbiological conversion of N-containing substrates. 4. On the microbiological conversion of 5-hydroxyindole through Clavic eps purpurea, Cordyceps militaris and Aspergillus oryzae].

[Article in German]

Mutschler E, Rochelmeyer H, Wolffling D

PMID: 5302347, UI: 68393721

Arch Pharm Ber Dtsch Pharm Ges 1968 Apr;**301(4):**287-291

[On the microbiological conversion of N-containing substrates. 3. On the determination of the constitution oc conversion products of 5-hydroxyindole through Cordyceps militaris].

[Article in German]

Mutschler E, Rochelmeyer H, Wolffling D

PMID: 5302346, UI: 68393720

Planta Med 1967 Feb;**15(1):**97-103

[On the microbiological conversion of N-containing substrates. 1. On the microbiological acetylation of amines by Cordyceps militaris].

[Article in German]

Munzner R, Mutschler E, Rummel M

PMID: 5606161, UI: 69109204

Biochem Biophys Res Commun 1964;**14:**456-457

Identification of cordycepin, a metabolite of Cordyceps militaris, as 3'-deoxyadenosine.

Kaczka EA, Trenner NR, Arison B, Walker RW, Folkers K

PMID: 5836541, UI: 66020578

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26 citations found

Appl Environ Microbiol 1997 Oct;**63(10):**3919-3925

Comparison of phenanthrene and pyrene degradation by different wood-decaying fungi.

Sack U, Heinze TM, Deck J, Cerniglia CE, Martens R, Zadrazil F, Fritsche W

[Medline record in process]

The degradation of phenanthrene and pyrene was investigated by using five different wood-decaying fungi. After 63 days of incubation in liquid culture, 13.8 and 4.3% of the [ring U-14C]phenantherene and 2.4 and 1.4% of the [4,5,9,10-14C]pyrene were mineralized by Trametes versicolor and Kuehneromyces mutabilis, respectively. No 14CO2 evolution was detected in either [14C]phenanthrene or [14C]pyrene liquid cultures of Flammulina velutipes, Laetiporus sulphureus, and Agrocybe aegerita. Cultivation in straw cultures demonstrated that, in addition to T. versicolor (15.5%) and K. mutabilis (5.0%), L. sulphureus (10.7%) and A. aegerita (3.7%) were also capable of mineralizing phenanthrene in a period of 63 days. Additionally, K. mutabilis (6.7%), L. sulphureus (4.3%), and A. aegerita (3.3%) mineralized [14C]pyrene in straw cultures. The highest mineralization of [14C] pyrene was detected in straw cultures of T. versicolor (34.1%), which suggested that mineralization of both compounds by fungi may be independent of the number of aromatic rings. Phenanthrene and pyrene metabolites were purified by high-performance liquid chromatography and identified by UV absorption, mass, and 1H nuclear magnetic resonance spectrometry. Fungi capable of mineralizing phenanthrene and pyrene in liquid culture produced enriched metabolites substituted in the K region (C-9,10 position of phenanthrene and C-4,5 position of pyrene), whereas all other fungi investigated produced metabolites substituted in the C-1,2, C-3,4, and C-9,10 positions of phenanthrene and the C-1 position of pyrene.

PMID: 9327556, UI: 97468469

J Biol Chem 1997 Aug 8;**272(32):**20044-20048

Dimerization of the N-terminal amphipathic alpha-helix domain of the fungal immunomodulatory protein from Ganoderma tsugae (Fip-gts) defined by a yeast two-hybrid system and site-directed mutagenesis.

Lin WH, Hung CH, Hsu CI, Lin JY

A fungal immunomodulatory protein (Fip-gts) was purified from Ganoderma tsugae. The DNA encoding Fip-gts was isolated from a cDNA library of G. tsugae by reverse transcriptase-polymerase chain reaction. The complete amino acid sequence of Fip-gts, deduced from the nucleotide sequence of the cDNA, was the same as LZ-8 isolated from Ganodermn lucidum. Recombinant Fip-gts was expressed as a glutathione S-transferase fusion

protein in Escherichia coli with a yield of 20 mg/liter of culture. Recombinant Fip-gts, purified to homogeneity, had the same blast formation stimulatory activity to human peripheral blood lymphocytes as native Fip-gts. The yeast two-hybrid system and site-directed mutagenesis were used to determine whether dimerization of Fip-gts occurred. Deletion analysis of the N-terminal amphipathic alpha-helix domain of Fip-gts identified a sequence of about 10 amino acids responsible for inducing immunomodulatory activity. Non-functional Fip-gts deletion mutants did not form dimers, whereas wild type Fip-gts did as determined by gel filtration. A mutant with deletions at Leu-5, Phe-7, and Leu-9 lost the amphipathic characteristics of the N-terminal domain and the ability to form dimers as well as its immunomodulatory activity. Fusion of Fip-gts with the DNA binding and the transactivation domains of GAL4 resulted in the activation of the lacZ activator gene, indicating the interaction of Fip-gts with it itself. The dimerization domain was further defined by analyzing the ability of the N-terminal 13 amino acids or Leu-5, Phe-7, and Leu-9 deletion mutants of Fip-gts to interact with the wild type Fip-gts. These experiments confirmed the N-terminal amphipathic alpha-helix as the dimerization domain and suggest that the dimerization of Fip-gts may play an important role in Fip-gts immunomodulatory activity.

PMID: 9242675, UI: 97390442

J Formos Med Assoc 1997 Jul;**96(7):**517-524

Molecular cloning and expression of a fungal immunomodulatory protein, FIP-fve, from Flammulina velutipes.

Ko JL, Lin SJ, Hsu CI, Kao CL, Lin JY

FIP-fve, a fungal immunomodulatory protein, was isolated from the fruiting bodies of the edible mushroom, Flammulina velutipes. FIP-fve was shown to stimulate blast-forming activity of human peripheral blood lymphocytes and gene expression of interleukin-2, interferon-gamma and tumor necrosis factor-alpha. Repeated administration of FIP-fve to mice inhibits the Arthur and systemic anaphylaxis reactions. FIP-fve cDNA was cloned and sequenced, and the amino acid sequence of FIP-fve deduced from the nucleotide sequence is identical to that previously determined by protein sequencing. FIP-fve cDNA was amplified by polymerase chain reaction, ligated into the expression vector, pGEX-2T, and expressed in Escherichia coli as a fusion protein of glutathione S-transferase (GST) and FIP-fve. The GST-FIP-fve fusion protein was soluble, and the yield of recombinant FIP-fve was about 5 mg/L of induced culture. The recombinant FIP-fve was obtained by cleaving the GST-FIP-fve fusion protein with thrombin and purifing to homogeneity. The recombinant FIP-fve had about 50% of the immunomodulatory activity of the native FIP-fve.

PMID: 9262056, UI: 97405413

Biochem J 1997 Apr 15;**323(Pt 2):**557-565

Fip-vvo, a new fungal immunomodulatory protein isolated from Volvariella volvacea.

Hsu HC, Hsu CI, Lin RH, Kao CL, Lin JY

A new fungal immunomodulatory protein (Fip) has been purified from the edible mushroom, Volvariella volvacea, and designated Fip-vvo. Analysis of the purified protein by SDS/PAGE followed by Coomassie Blue staining demonstrated that Fip-vvo is a single polypeptide with an apparent molecular mass of 15 kDa. Periodic acid/Schiff staining showed that this single polypeptide lacks carbohydrates. Using an in vitro bioassay measuring blast-formation stimulatory activity, Fip-vvo was shown to stimulate the maximum proliferation of human peripheral blood lymphocytes at a concentration of 5 microg/ml. Fip-vvo was capable of agglutinating rat red blood cells.

Neither haemagglutination nor mitogenic activities were inhibited by mono- or dimeric sugars. In vivo, repeat administration of Fip-vvo greatly reduced the production of BSA-induced Arthus reaction in mice, whereas little effect was observed on the prevention of systemic anaphylaxis reactions. The selectively enhanced transcriptional expression of interleukin (IL)-2, IL-4, interferon-gamma, tumour necrosis factor-alpha, lymphotoxin and IL-2 receptor by Fip-vvo was also demonstrated by reverse transcriptase-PCR. This finding suggests that Fip-vvo exerts its immunomodulatory effects via cytokine regulation. In addition, the complete amino acid sequence of Fip-vvo was obtained by direct protein sequencing. This protein consists of 112 amino acid residues with a blocked N-terminal end and has a calculated molecular mass of 12667 Da not including the N-terminal blocking group. By gel filtration analysis, Fip-vvo exhibited a molecular mass of 26 kDa for the native molecules in PBS. This result indicates that native Fip-vvo is most likely a non-covalently associated homodimeric molecule.

PMID: 9163352, UI: 97250660

Immunopharmacology 1997 Jan;**35(3):**255-263

The isolation and characterization of an immunomodulatory and anti-tumor polysaccharide preparation from Flammulina velutipes.

Leung MY, Fung KP, Choy YM

Alkaline-soluble antitumor polysaccharide was prepared from the cell wall of the mushroom Flammulina velutipes. The backbones) of the polysaccharide is mainly composed of beta-(1-->3)-D-linked glucose and its molecular weight was estimated to be about 200 kD. The polysaccharide was found to be non-toxic by brine shrimp assay. When injected into mice intraperitoneally, the polysaccharide triggered proliferation of splenic lymphocytes and also vascular dilation and hemorrhage (VDH) response. The polysaccharide exhibited potent anti-tumor activity against sarcoma SC-180 in vivo but not in vitro.

PMID: 9043939, UI: 97196850

Eur J Cell Biol 1996 Oct;**71(2):**216-220

Cellular graviperception in the basidiomycete Flammulina velutipes--can the nuclei serve as fungal statoliths?

Monzer J

In search for the cellular mechanisms of graviperception in basidiomycete fruit bodies, nuclear and vacuole motility was investigated in the fungus, Flammulina velutipes. In this organism, hyphal nuclei are closely linked with the actin cytoskeleton, which is involved in gravity perception. Active motion of the nuclei appears aligned with the axis of gravity, and is maintained after spatial reorientation of the cell. The vacuoles showed low motility not aligned with the gravity axis at all. The nuclear density was determined with 1.22 g/cm3. Calculation of the forces exerted by the nuclei shows that nuclear displacement in the submicrometer range already fulfills the physical minimum condition for a statolith. Based on these findings, a function of nuclei as statoliths in basidiomycete hyphae is proposed.

PMID: 8905300, UI: 97061270

Eur J Biochem 1995 Mar 1;**228(2):**244-249

A new fungal immunomodulatory protein, FIP-fve isolated from the edible mushroom, Flammulina velutipes and its complete amino acid sequence.

Ko JL, Hsu CI, Lin RH, Kao CL, Lin JY

A new fungal immunomodulatory protein (FIP-fve) has been isolated and purified from the edible golden needle mushroom (Flammulina velutipes). The apparent molecular mass of FIP-fve determined by SDS/PAGE agrees well with the value of 12704 Da calculated from its amino acid composition and sequence. The complete amino acid sequence of FIP-fve was elucidated by protein sequencing techniques. FIP-fve consists of 114 amino acid residues with an acetylated amino end, and lacks methionine, half-cystine and histidine residues. FIP-fve was able to hemagglutinate human red blood cells. The immunomodulatory activity of FIP-fve was demonstrated by its stimulatory activity toward human peripheral blood lymphocytes, and its suppression of systemic anaphylaxis reactions and local swelling of mouse footpads. FIP-fve was found to enhance the transcriptional expression of interleukin-2 and interferon-gamma.

PMID: 7705335, UI: 95220348

Eur J Cell Biol 1995 Feb;**66(2):**151-156

Actin filaments are involved in cellular graviperception of the basidiomycete Flammulina velutipes.

Monzer J

Inhibitor studies demonstrate a major role of the actin cytoskeleton in cellular graviperception of the basidiomycete Flammulina velutipes. Treatment of explanted fruiting body stipes with 10(-4) M of the actin filament-disrupting agent cytochalasin D causes specific suppression of gravitropic curvature to 21% of the control value. Elongation growth is depressed to 48%. In contrast, curvature and elongation remain almost unaffected by 10(-4) M of the microtubule inhibitor oryzalin. Immunohistochemical labeling of actin filaments in stipe hyphae of Flammulina reveals a close colocalization with the nuclei. The label pattern is destroyed upon 10(-4) M cytochalasin treatment. The role of the actin cytoskeleton in graviperception in Flammulina parallels aspects of gravisensing in Chara rhizoids and thus points at basic similarities between fungal and plant mechanisms of cellular gravity perception.

PMID: 7774601, UI: 95292984

J Nutr Sci Vitaminol (Tokyo) 1994 Apr;**40(2):**81-94

Distribution of ascorbic acid analogs and associated glycosides in mushrooms.

Okamura M

Mushrooms contain reducing substances with chemical properties similar to ascorbic acid (AsA). In this study, the four types of reducing substances contained in Flammulina velutipes (Enokitake), Hypsizigus mamoreus (Bunashimeji), Pholiota nameko (Nameko), and Grifola frondosa (Maitake) were respectively purified, and the structure of each was analyzed using nuclear magnetic resonance (NMR) and other methods. The results confirmed that those substances were AsA analogs and associated glycosides (6-deoxy-AsA, 6-deoxy-5-O-(alpha-

D-xylopyranosyl)-AsA, 6-deoxy-5-O-(alpha-D-glucopyranosyl)-AsA, and 5-O-alpha-D-glucopyranosyl-erythro-AsA). These substances were characteristic in that saccharide was bonded with the C-5 of the AsA analogs. Osazones were formed from the reducing substances in 19 kinds of edible mushrooms. Using thin-layer chromatography (TLC), they were developed to examine the distribution of the above reducing substances and AsA. The results showed that at least one of the above compounds was certain to be present in any mushroom; that AsA was present in very small quantities if at all; and that several substances similar to the above compounds were present.

PMID: 7931730, UI: 95017161

Toxicon 1994 Jan;**32(1):**11-15

Data on arsenic and cadmium contents of some common mushrooms.

Vetter J

The arsenic and cadmium contents of 88 samples of mushrooms were determined. The majority of samples have a very low (practically zero) arsenic level; however, significant accumulations were found in the Agaricus species and in Macrolepiota rhacodes (which is related to the Agaricaceae family) and in three Tricholomataceae species (Flammulina velutipes, Lepista nebularis and Clitocybe, inversa). The average cadmium content of all samples was 4.91 ppm (0.28-86 ppm) on a dry weight basis. The highest concentration (34.9 ppm) was found to be characteristic of genus Agaricus. The accumulation potential of genus Russula is lower, and it appears that this content is more characteristic in three sections (Ingratea, Heterophyllae and Xerampelinae), whereas the others have a low (normal) cadmium level. These data confirm that the accumulation ability is genetically coded, thus, only certain taxonomical groups of fungi play a toxicological role. Our data offer new information about the concentration of two toxic elements of particular mushroom species as well as in other taxonomic groups. These data are of great importance in view of toxicology, food chemistry and, partly, environmental protection.

PMID: 9237332, UI: 97380557

Sci Total Environ 1991 Jun;**105:**29-39

Concentrations of radiocesium and potassium in basidiomycetes collected in Japan.

Muramatsu Y, Yoshida S, Sumiya M

Concentrations of 137Cs, 134Cs and 40K in about 60 mushroom samples (fruit bodies of basidiomycetes) belonging to 25 species collected in Japan have been studied. The levels of 137Cs varied very widely, ranging from less than 3 to 1520 Bq kg-1 (dry wt), while those of 40K were relatively constant. Concentrations of 137Cs in common edible mushrooms of Japan such as Lentinus edodes, Flammulina velutipes, Pleurotus ostreatus and Pholiota nameko were low (normally less than 50 Bq kg-1, dry wt). Concentrations of 134Cs in many samples were below the limit of detection (usually less than 5 Bq kg-1, dry wt). The median concentrations of 137Cs and 40K were 41 (dry wt) and 1150 Bq kg-1 (dry wt), respectively. From the 137Cs/40K ratios it was found that cesium rather than potassium was selectively taken up from the soils by fungi such as Suillus granulatus and Lactarius hatsudake. The 134Cs/137Cs ratios in mushrooms are related to the depth of the mycelium in the soil. The effective dose equivalent due to the dietary intake of radiocesium through mushrooms was estimated to be only 1.6 x 10(-7) Sv.

PMID: 1925522, UI: 92022497

Agric Biol Chem 1990 Mar;**54(3):**587-592

Oligonucleotidase activity of phosphodiesterase from the fruit body of Flammulina velutipes.

Kurosawa S, Shimabuku AM, Ishizawa H, Sen K

A phosphodiesterase (EC 3.1.4.1) was purified to homogeneity from the fruit body of Flammulina velutipes. The enzyme had considerable activity toward oligonucleotides. The Km values were 0.66 mM for ApA, 2.47 mM for (Ap)2A, and 3.03 mM for (Ap)3A. The enzyme hydrolyzed oligodeoxyribonucleotides as well as oligoribonucleotides. The oligoribonucleotides bearing a phosphate residue at the 3' end were not hydrolyzed by the enzyme. The enzyme hydrolyzed the oligoribonucleotides exonucleolytically from the 3' to 5' end. Thus the PDase of F. velutipes is considered to function in vivo as an oligonucleotidase (EC 3.1.13.3), which efficiently converts oligonucleotides to 5'-mononucleotides in the cell.

PMID: 1369259, UI: 90351586

Hua Hsi I Ko Ta Hsueh Hsueh Pao 1988 Jun;**19(2):**146-149

[Study on the inhibition of solid form of S-180 through water soluble polysaccharides from Flammulina velutipes].

[Article in Chinese]

Zhao CY, Yang Y, Li H, Zheng XL, Yang FH, Li Q

PMID: 3198094, UI: 89065675

Toxicon 1987;**25(11):**1145-1152

Some properties of flammutoxin from the edible mushroom Flammulina velutipes.

Bernheimer AW, Oppenheim JD

A cytolytic toxin from the basidiocarps of the edible mushroom Flammulina velutipes was purified to homogeneity. The lysin, flammutoxin, is a single polypeptide chain of Mr 32,000 and pK about 5.4. It contains unusually large amounts of tryptophan, serine and glycine, and few or none of the sulfur-containing amino acids. Erythrocytes of rat, rabbit, guinea pig, man, mouse, cat and dog were sensitive to lysis, in that order, whereas erythrocytes of sheep, ox, goat, swine and horse were largely or completely resistant to lysis. The toxin appears not to be a phospholipase and it was not inhibitable by any of a variety of lipids. Hemolysis probably involves alteration of the erythrocyte membrane, with formation of submicroscopic ion channels, and it appears to be of the osmotic type. In some respects flammutoxin resembles phallolysin, a cytolytic toxin obtained from the mushroom Amanita phalloides.

PMID: 3433291, UI: 88127810

Curr Genet 1987;**12(1):**33-36

Inversion of 5S ribosomal RNA genes within the genus Coprinus.

Cassidy JR, Pukkila PJ

In the basidiomycete fungus Coprinus cinereus, the 5S ribosomal RNA (rRNA) genes are found in the rDNA repeat which encodes the other three rRNAs (18S, 5.8S, and 26S), and all genes are transcribed in the same direction (Cassidy et al. 1984). To facilitate examination of the rRNA gene organization in additional species, we developed a method to permit determination of the direction of transcription of the rRNA genes using crude preparations of genomic DNA. We used this method to determine the organization of the rDNA in five other members of the order Agaricales (Flammulina velutipes, Agaricus bisporus, Coprinus micaceus, Coprinus atramentarius, and Coprinus comatus). In four, the organization is the same as it is in Coprinus cinereus. However, in Coprinus comatus, the 5S RNA gene is present in the rDNA repeat, but is transcribed in the opposite direction. This alteration in rDNA organization within the genus Coprinus indicates that inverted 5S genes can arise and become propagated through the tandem array of genes. The presence of orientation-dependent promoter elements within the spacer DNA (Elion and Warner 1984) would be expected to place constraints on such inversions.

PMID: 2835172, UI: 88210521

Jpn J Cancer Res 1985 Feb;**76(2):**142-148

Proflamin, a new antitumor agent: preparation, physicochemical properties and antitumor activity.

Ikekawa T, Maruyama H, Miyano T, Okura A, Sawasaki Y, Naito K, Kawamura K, Shiratori K

Proflamin is a new biological response-modifying antitumor agent. It was isolated from the culture mycelium of Flammulina velutipes (Curt. ex Fr.) Sing. by means of ion exchange column chromatography and molecular sieving. It is a weakly acidic glycoprotein containing more than 90% protein and less than 10% carbohydrate, and its molecular weight is 13,000 +/- 4,000. The antitumor effect of proflamin was studied with murine tumors. It was markedly effective against the syngeneic tumors, B-16 melanoma (B-16) and adenocarcinoma 755 (Ca-755). At a dose of 10 mg/kg po, the increases in median survival time of mice with B-16 and Ca-755 were 86 and 84%, respectively. Proflamin exhibited no cytocidal effect against the cultured cell lines in vitro. Oral administration of proflamin produced no lethal or any other apparent adverse effect in mice.

PMID: 3920103, UI: 85155210

J Nutr Sci Vitaminol (Tokyo) 1984 Dec;**30(6):**561-567

Effect of protein intake level on urinary energy/nitrogen ratio in Japanese.

Kaneko K, Koike G

Urinary energy/nitrogen ratios were determined in 179 female and 14 male subjects given protein from various sources and at various intake levels. The ratio decreased with increasing protein intake from zero to 1 g/kg/day but was constant when protein intake was between 1 to 1.8 g/kg/day. The ratio was not affected by the variety of protein source. There was no difference between the data for semisynthetic diet and conventional diet. Mean values and standard deviations of the ratio in men and women given the diet containing 1.0 to 1.8 g protein/kg/day were 9.06 +/- 0.56 (n = 14) and 8.19 +/- 0.81 (n = 37) kcal/kg N, respectively. The difference between two figures

in men and women was significant (p less than 0.05). The mean values of urinary E/N ratio actually measured did not approach those of urea (5.34 kcal/g N), the principal nitrogenous compound in urine, the proportion of which increased at higher protein intake level. Characteristically high ratios were obtained in the ma-konbu (Laminaria japonica) and enokitake (Flammulina velutipes) diet groups. The results suggest that urinary energy originates not only from nitrogen-containing compounds but also from other organic compounds containing no nitrogen. Therefore, further investigation is necessary to evaluate the urinary E/N ratio applicable to the urinary loss of incompletely oxidized nitrogenous compounds.

PMID: 6533275, UI: 85184920

J Pharmacobiodyn 1983 Feb;**6(2):**96-104

Intensification of antitumor-immunity by protein-bound polysaccharide, EA6, derived from Flammulina velutipes (Curt. ex Fr.) Sing. combined with murine leukemia L1210 vaccine in animal experiments.

Otagiri K, Ohkuma T, Ikekawa T, Tanaka S

The antitumor effect of protein-bound polysaccharide, EA6, derived from fruit bodies of Flammulina velutipes (Curt. ex Fr.) Sing., when combined with a vaccine treatment was studied by the challenge test in BDF1 mice and L1210 murine leukemia system. Intensification of the antitumor effect of EA6 was dependent on doses, timing, and frequency of intraperitoneal administration of the material to the immunization by concanavalin A and/or glutaraldehyde treated L1210 vaccine. Administration of EA6 prior to the injection of the vaccine, or repeated injection of more than 4 times did not increase the life span of the animals. But when EA6 was given (40 mg/kg) after the injection of the vaccine, marked prolongation of the life span (ILS of 223%) was observed against challenging of 1 x 10(2) cells of L1210. Combined treatment of EA6 with vaccine exhibited prolonged ILS in the mice challenged with 1 x 10(3) cells of L1210. The specific immunity for L1210 induced by the vaccine was not affected by EA6.

PMID: 6683307, UI: 83241080

J Pharmacobiodyn 1983 Feb;**6(2):**88-95

Augmentation of host's immunity by combined cryodestruction of sarcoma 180 and administration of protein-bound polysaccharide, EA6, isolated from Flammulina velutipes (Curt. ex Fr.) Sing. in ICR mice.

Ohkuma T, Tanaka S, Ikekawa T

Augmentation of the host's immunity by combined in situ freeze-destruction of the tumor (cryosurgery) and administration of the antitumor active protein-bound polysaccharide, EA6, isolated from a hot water extract of an edible mushroom, Flammulina velutipes (Curt. ex Fr.) Sing., was investigated in sarcoma 180 bearing ICR mice. Oral administration (p.o.) of the EA6 stimulated anti-sheep red blood cells (SRBC) IgM antibody-producing activity of the spleen cells, and also delayed hypersensitivity (DTH) against SRBC in swelling of the foot pads of the tumor-bearing hosts. When EA6 p.o. was combined with cryosurgery, further augmentation of IgM-producing activity and DTH reaction to SRBC was recognized as compared with the EA6 single use. But the reticuloendothelial system of the mice, estimated by carbon clearance test, was not activated by EA6 p.o. or combined with cryosurgery.

PMID: 6683306, UI: 83241079

J Pharmacobiodyn 1982 Aug;**5(8):**576-581

Studies on antitumor polysaccharides of Flammulina velutipes (Curt. ex Fr.) Sing.II. The structure of EA3 and further purification of EA5.

Ikekawa T, Ikeda Y, Yoshioka Y, Nakanishi K, Yokoyama E, Yamazaki E

An antitumor polysaccharide, EA3 isolated from a Japanese edible mushroom, Flammulina velutipes (CURT. ex FR.) SING. is composed of D-glucose. Studies to determine its structure were performed by mean of partial acid hydrolysis, acetolysis and the chemical analysis of the complete hydrolysates of the fully methylated polysaccharide. Thus the chemical structure of EA3 was found to be that of a beta-(1 leads to 3)-glucan. Another antitumor polysaccharide (EA5) also isolated from F. velutipes was fractionated on a concanavalin A-Sepharose 4B column. The active antitumor component was further purified by column chromatography on Sephadex G-200. Among the polysaccharides isolated the highest molecular weight polysaccharide (EA501) showed the highest rate of antitumor activity. The component sugar of EA501 were found to be D-glucose 42.3%, D-galactose 17.3%, D-mannose 12.2%, D-xylose 6.7% and L-arabinose 14.7%.

PMID: 6891400, UI: 83111385

Biokhimiia 1982 Jul;**47(7):**1181-1185

[Analysis of the component constitution and substrate specificity of a fibrinolytic preparation from the fungus Flammulina velutipes].

[Article in Russian]

Morozova EN, Falina NN, Denisova NP, Barkova LV, Psurtseva NV

The degree of heterogeneity of the proteolytic complex from the fungus Flammulina velutipes was studied by gel chromatography and analytical isoelectrofocusing. The fibrinolytic, thrombolytic, caseinolytic, endo- and aminopeptidase activities of the enzyme complex were compared to those of Aspergillus terricola and Streptomyces griseus proteinases. The proteolytic complex under study consists of at least two proteinases with pI 6.1 and 7.1, which possess fibrinolytic, thrombolytic and endopeptidase activities and of two aminopeptidases with pI 5.5 and 6.05. All these activities are inhibited by metal-chelating reagents. A low caseinolytic activity of the complex suggests that it can successfully be employed as a therapeutic agent.

PMID: 7052148, UI: 83000586

J Pharmacobiodyn 1982 Jun;**5(6):**439-444

Augmentation of antitumor activity by combined cryo-destruction of sarcoma 180 and protein-bound polysaccharide, EA6, isolated from Flammulina velutipes (Curt. ex Fr.) Sing. in ICR mice.

Ohkuma T, Otagiri K, Ikekawa T, Tanaka S

Augmentation of antitumor activity by combined in situ freeze-destruction of tumor (cryosurgery) and administration of antitumor active substances isolated from a hot water extract of an edible mushroom, Flammulina velutipes (Curt. ex Fr.) SING., was investigated in sarcoma 180 bearing ICR mice. Antitumor active substances of the mushroom included beta-(1,3)-glucan (EA3) and protein-bound polysaccharide (EA6). Antitumor activity was evaluated by the growth rate of the solid tumor rechallenged subcutaneously (s.c.) or by cumulative mortalities of the mice rechallenged intraperitoneally (i.p.) with the ascites tumor, on day 7 after cryosurgery. Weak antitumor effect induced by cryosurgery against challenged solid tumor of sarcoma 180 was markedly augmented by i.p. administration of EA6 (10 mg/kg). Cryosurgery of the solid sarcoma 180 apparently did not induce any antitumor effect against challenged ascites sarcoma 180. However, when cryosurgery was combined with oral administration of the polysaccharides (50 mg/kg), prolonged survival of the mice challenged with ascites sarcoma 180 i.p. was recognized by EA6, but not by EA3. Timing of the administration of EA6 (i.p.) with cryosurgery was best in pre- and post-cryosurgery. Immunological activity of EA6 to the host was discussed.

PMID: 6889646, UI: 83009613

Toxicon 1975 Nov;**13(5):**323-331

Toxicity of the cardiotoxic protein flammutoxin, isolate from edible mushroom Flammulina velutipes.

Lin JY, Wu HL, Shi GY

PMID: 54950, UI: 76105384

Chem Pharm Bull (Tokyo) 1973 Aug;**21(8):**1772-1776

Studies on antitumor polysaccharides of Flammulina velutipes (Curt. ex Fr.) Sing. I.

Yoshioka Y, Sano T, Ikekawa T

PMID: 4756821, UI: 74041402

Cancer Chemother Rep 1973 Feb;**57(1):**85-86

Studies on the antitumor activity of polysaccharides from Flammulina velutipes (Curt. ex Fr.) Sing.

Ikekawa T, Yoshioka Y, Emori M, Sano T, Fukuoka F

PMID: 4735779, UI: 73176256

Folia Microbiol (Praha) 1967;**12(6):**567-568

Antibiotics of Flammulina velutipes cultivated in submerged culture.

Kozova J, Rehacek Z

PMID: 4965922, UI: 68126098

59 citations found (Ganoderma lucidum)

Microbiologia 1997 Jun;**13(2):**185-192

Production of carpophores of Lentinus edodes and Ganoderma lucidum grown on cork residues.

Riu H, Roig G, Sancho J

Cork, being widely used in industry, generates high amounts of waste of difficult elimination because of its complex biological degradation, and the high pollutant smokes from its burning. Similarities between suberin (major component of cork) and lignin suggest that fungi with high lignin degrading capacity could colonize cork residues. Basidiomycetes such as Lentinus edodes and Ganoderma lucidum, besides their capacity for degrading, are edible. Thus, while using them to degrade cork, it is also possible to obtain a food product. In this study, dry matter was reduced 40%, suberin was degraded 45%, oxidizable carbon was increased 35%, and Lentinus showed a high rate of growth. These results indicate that there is an environmental alternative to the elimination of residues from the cork industry.

PMID: 9253758, UI: 97397901

Planta Med 1997 Jun;**63(3):**224-227

Antinociceptive components of Ganoderma lucidum.

Koyama K, Imaizumi T, Akiba M, Kinoshita K, Takahashi K, Suzuki A, Yano S, Horie S, Watanabe K, Naoi Y

The antinociceptive effects 134 extracts prepared from 45 species of mushrooms were examined by the acetic acid-induced writhing method. From the CH2Cl2 extract of Ganoderma lucidum among the active extracts, ganoderic acids A, B, G and H and compound C6 were isolated as the antinociceptive components.

PMID: 9225603, UI: 97369115

Biol Pharm Bull 1997 Apr;**20(4):**417-420

Antifibrotic effects of a polysaccharide extracted from Ganoderma lucidum, glycyrrhizin, and pentoxifylline in rats with cirrhosis induced by biliary obstruction.

Park EJ, Ko G, Kim J, Sohn DH

For the past few years, we have been investigating polysaccharides from Ganoderma lucidum as antifibrotic agents. In a previous study, we discovered that polysaccharides extracted from G. Iucidum lowered the collagen content in liver but had no effect on serum biochemical parameters in rats subjected to bile duct ligation and scission-induced fibrosis. In this study, we changed the extraction method and obtained polysaccharides extracted from G. Iucidum. The polysaccharide from G. Iucidum reduced the serum aspartate transaminase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP) and total bilirubin and also reduced the collagen content in liver and improved the morphology. Pentoxifylline, which is reported to exhibit an antifibrotic effect in pigs with fibrosis induced by yellow phosphorus, did not have any antifibrotic effects in fibrosis induced by biliary obstruction. Glycyrrhizin, which is used in the treatment of hepatitis, reduced serum ALT and AST values but there was no significance. It had no effect on liver hydroxyproline content which implies that glycyrrhizin has no antifibrotic effect in the rats with fibrosis induced by bile duct ligation and scission. These data suggest that the polysaccharide from Ganoderma lucidum could be a promising antifibrotic agent. However, further study is needed to understand the inhibition mechanism of collagen deposition of polysaccharides from Ganoderma Iucidum and its clinical applicability remains to be established.

PMID: 9145221, UI: 97290575

Int J Cancer 1997 Mar 17;**70(6):**699-705

The anti-tumor effect of Ganoderma lucidum is mediated by cytokines released from activated macrophages and T lymphocytes.

Wang SY, Hsu ML, Hsu HC, Tzeng CH, Lee SS, Shiao MS, Ho CK

The present study was to ascertain the immunomodulating and anti-tumor effects of Ganoderma (G.) lucidum. Polysaccharides (PS) from fresh fruiting bodies of G. lucidum (PS-G) were isolated and used to potentiate cytokine production by human monocytes-macrophages and T lymphocytes. Our results had shown that the levels of interleukin (IL)-1 beta, tumor necrosis factor (TNF)- alpha, and IL-6 in macrophage cultures treated with PS-G (100 micrograms/ml) were 5.1-, 9.8- and 29-fold higher, respectively, than those of untreated controls. In addition, the release of interferon (IFN)- gamma from T lymphocytes was also greatly promoted in the presence of PS-G (25-100 micrograms/ml). Furthermore, these cytokine-containing mononuclear cell-conditioned media (PSG-MNC-CM) were found to suppress the proliferation and clonogenicity of both the HL-60 and the U937 leukemic cell lines. DNA labeling and gel electrophoresis showed that treatment with PSG-MNC-CM markedly induced leukemic-cell apoptosis. Flow-cytometric analysis revealed that few (2.3 +/- 0.8%) apoptotic cells were seen in the control cultures, while PSG-MNC-CM treatment resulted in a significant increase in the apoptotic population both in the HL-60 (38.3 +/- 4.5%) and in the U937 (44.5 +/- 3.8%) cells. In addition, 40 to 45% of the treated leukemic cells were triggered to differentiate into mature monocytic cells expressing CD14 and CD68 surface antigens. However, PS-G alone had no such effects even at a higher dose of 400 micrograms/ml. Since untreated macrophages and T lymphocytes produced little or no cytokine, and normal MNC-CM did not suppress leukemic cell growth, it was suggestive that the anti-tumor activity of PSG-MNC-CM was derived from the elevated levels of cytokines. Antibody-neutralization studies further revealed that the anti-tumor cytokines in the PSG-MNC-CM were mainly of TNF- alpha and IFN- gamma, and these 2 cytokines acted synergistically on the inhibition of leukemic-cell growth.

PMID: 9096652, UI: 97250969

Mol Cells 1997 Feb 28;**7(1):**52-57

Suppressive effects of Ganoderma lucidum on proliferation of peripheral blood mononuclear cells.

Kim RS, Kim HW, Kim BK

The basidiocarps of Ganoderma lucidum have been used for prevention and treatment of various diseases in the Orient. Methanolic extracts of this mushroom were applied to human peripheral blood mononuclear cell (PBMC) culture systems in the presence of various immunostimulating or immunosuppressive agents. Phytohemagglutinin-induced cell proliferation was reduced to 14% of that of the control by a GLE fraction that is the neutral component of the methanolic extracts of the carpophores. 12-O-tetradecanoylphorbol 13-acetate (TPA)-induced cell proliferation was inhibited by the fractions of GLA, GLC, GLE and GLG. However none of these fractions inhibited proliferation of the PBMCs stimulated with TPA plus ionomycin (IM). Treatment of the PBMCs with cyclosporin A (CsA) led to blockage of the cell proliferation to 9% of that of the control. When the cells were cultured with the methanolic fractions in the presence of CsA, concentration dependent inhibition of the cell proliferation was observed by the addition of GLE and GLG fractions. On the contrary, the GLH fraction recovered the CsA induced inhibition of the cell proliferation. Taken together, among the methanolic fractions, GLE showed the highest inhibitory activity. This fraction might inhibit the protein kinase C signal pathway and accelerate the CsA signal pathway.

PMID: 9085265, UI: 97239603

Phytochemistry 1997 Jan;**44(1):**7-10

A lectin from mycelia of the fungus Ganoderma lucidum.

Kawagishi H, Mitsunaga S, Yamawaki M, Ido M, Shimada A, Kinoshita T, Murata T, Usui T, Kimura A, Chiba S

A lectin (GLL-M) was isolated from mycelia of Ganoderma lucidum using affinity chromatography on BSM-Toyopearl. GLL-M is a monomer in its native form with a M(r) of 18,000. Another lectin was also purified from fruiting bodies of the same fungus. The two lectins were partially compared with each other.

PMID: 8983213, UI: 97137876

Appl Environ Microbiol 1996 Oct;**62(10):**3739-3744

Isolation of laccase gene-specific sequences from white rot and brown rot fungi by PCR.

D'Souza TM, Boominathan K, Reddy CA

Degenerate primers corresponding to the consensus sequences of the copper-binding regions in the N-terminal domains of known basidiomycete laccases were used to isolate laccase gene-specific sequences from strains representing nine genera of wood rot fungi. All except three gave the expected PCR product of about 200 bp. Computer searches of the databases identified the sequence of each of the PCR products analyzed as a laccase gene sequence, suggesting the specificity of the primers. PCR products of the white rot fungi Ganoderma lucidum, Phlebia brevispora, and Trametes versicolor showed 65 to 74% nucleotide sequence similarity to each other; the similarity in deduced amino acid sequences was 83 to 91%. The PCR products of Lentinula edodes and Lentinus tigrinus, on the other hand, showed relatively low nucleotide and amino acid similarities (58 to 64 and 62 to 81%, respectively); however, these similarities were still much higher than when compared with the corresponding regions in the laccases of the ascomycete fungi Aspergillus nidulans and Neurospora crassa. A few of the white rot fungi, as well as Gloeophyllum trabeum, a brown rot fungus, gave a 144-bp PCR fragment which had a nucleotide sequence similarity of 60 to 71%. Demonstration of laccase activity in G. trabeum and several other brown rot fungi was of particular interest because these organisms were not previously shown to produce laccases.

PMID: 8837429, UI: 96434462

Appl Environ Microbiol 1996 Apr;**62(4):**1354-1363

Differentiation and grouping of isolates of the Ganoderma lucidum complex by random amplified polymorphic DNA-PCR compared with grouping on the basis of internal transcribed spacer sequences.

Hseu RS, Wang HH, Wang HF, Moncalvo JM

Laccate polypores of the Ganoderma lucidum species complex are widespread white rot fungi of economic importance, but isolates cannot be identified by traditional taxonomic methods. Parsimony analysis of nucleotide sequences from the internal transcribed spacers (ITS) of the ribosomal gene (rDNA) distinguished six lineages in this species complex. Each ITS lineage may represent one or more putative species. While some isolates have identical ITS sequences, all of them could be clearly differentiated by genetic fingerprinting using random amplified polymorphic DNA (RAPD). To investigate the suitability of RAPD markers for taxonomic identification and grouping of isolates of the G. lucidum complex, RAPD fragments (RAPDs) were used as phenotypic characters in numerical and parsimony analyses. Results show that data from RAPDS do not distinguish the same clades as ITS data do. Groupings based on analysis of RAPD data were very sensitive to the choice of the grouping method used, and no consistent grouping of isolates could be proposed. However, analysis with RAPDs did resolve several robust terminal clades containing putatively conspecific isolates, suggesting that RAPDs might be helpful for systematics at the lower taxonomic levels that are unresolved by ITS sequence data. The limitations of RAPDs for systematics are briefly discussed. The conclusion of this study is that ITS sequences can be used to identify isolates of the G. lucidum complex, whereas RAPDs can be used to differentiate between isolates having identical ITS sequences. The practical implications of these results are briefly illustrated.

PMID: 8919797, UI: 97077230

Transplantation 1995 Sep 15;**60(5):**438-443

Ling Zhi-8: studies of a new immunomodulating agent.

van der Hem LG, van der Vliet JA, Bocken CF, Kino K, Hoitsma AJ, Tax WJ

Ling Zhi-8 (LZ-8) is a protein derived from the fungus Ganoderma lucidum and has immunomodulatory capacities. It was shown to be mitogenic toward mouse splenocytes in vitro and immunosuppressive in vivo by reducing antigen-induced antibody formation and by preventing completely the incidence of autoimmune diabetes in nonobese diabetic mice. In this study, the mitogenic effects of LZ-8 on human mononuclear cells are reported. In accordance to its mitogenic effect on mouse splenocytes, LZ-8 proved to be mitogenic for human PBMC. This mitogenic effect of LZ-8 apparently required the presence of monocytes. We also demonstrated it to be immunosuppressive in vitro in a human MLC performed in the absence of monocytes, using purified T cells and EBV-transformed allogeneic B cells. Furthermore, we tested LZ-8 for its possible suppressive effects in 2 different models of allogeneic tissue transplantation. LZ-8 proved to have a significant effect on cellular immunity, since its administration in an allografted mouse skin model resulted in an increased survival time. In a model of transplanted allogeneic pancreatic rat islets, LZ-8 was effective in delaying the rejection process of allografted islets. More frequent or continuous administration resulted in a further prolongation of survival time. No serious side effects of LZ-8 could be discerned in these experiments.

PMID: 7676490, UI: 95406938

J Ethnopharmacol 1995 Jun 23;**47(1):**33-41

Radical scavenger and antihepatotoxic activity of Ganoderma formosanum, Ganoderma lucidum and Ganoderma neo-japonicum.

Lin JM, Lin CC, Chen MF, Ujiie T, Takada A

The free radical scavenging and antihepatotoxic activity from Ganoderma lucidum, Ganoderma formosanum and Ganoderma neo-japonicum were studied. Treatment with the water extract of Ganoderma lucidum, Ganoderma formosanum and Ganoderma neo-japonicum caused a marked decrease in the CCl4-induced toxicity in rat liver, made evident by their effect on the levels of glutamic oxaloacetic transaminase (GOT) and lactic dehydrogenase (LDH) in the serum. The scavenging potency of the water extracts of the crude drugs was evaluated in terms of their ability to reduce the peaks of spin adducts using electron spin resonance (ESR) spin-trapping techniques. The results indicated that Ganoderma formosanum showed the greatest antihepatotoxic activity and the greatest free radical scavenging activity.

PMID: 7564419, UI: 96020922

Anticancer Res 1995 May;**15(3):**839-845

Trial of a new medium-term model using benzo(a)pyrene induced lung tumor in newborn mice.

Yun TK, Kim SH, Lee YS

A new medium-term in vivo model was tried using pulmonary adenoma induced by benzo(a)pyrene (BP) in newborn mice. Both inbred mice such as C57BL/5J, C57BR/cdJ. A/J mice and non inbred N:GP(S) mice were used. Benzo(a)pyrene was injected in the subscapular region of newborn mice within 24 hours after birth at a dose of 0.5 mg and 1 mg per mouse, respectively. After 9 weeks lung tumor induced in N:GP(S) and A/J mice but in the other mice. The dose showing a 50% tumor incidence was found in N:GP(S) mice to be 0.5 mg of BP but the tumor incidence was very high in A/J mice even at 40 micrograms of BP, the lowest dose in this experiment. To verify the utility of this model, ascorbic acid, carrot, beta carotene, soybean lecithin, spinach, Sesamum indicum, Ganoderma lucidum, caffeine, red ginseng extract, fresh ginseng and 13-cis retinoic acid, some of which are known to have anticarcinogenic activity in various animal models, were tried with this system. Ascorbic acid, soybean lecithin, Ganoderma lucidum, caffeine and red ginseng extract showed inhibition of lung tumor incidence, while fresh ginseng, carrot, beta carotene, spinach and 13-cis retinoic acid did not. This result suggested that the 9-week medium-term model using lung tumor induced by 0.5 mg of BP was useful for the screening of cancer preventive agents.

PMID: 7645968, UI: 95373943

Clin Exp Allergy 1995 May;**25(5):**440-447

Sensitization to Ganoderma lucidum in patients with respiratory allergy in India.

Singh AB, Gupta SK, Pereira BM, Prakash D

Although human sensitization to basidiomycete Ganoderma has been reported in New Zealand, North America and

Europe, hypersensitivity due to this fungi is not known in India, in spite of its prevalence in the atmosphere. We have studied the atmospheric concentration of Ganoderma in different localities within Delhi and the sensitization level to this fungi amongst the Indian population. Aerobiological sampling, using a Burkard personal slide sampler, was carried out in Delhi for 2 consecutive years (October 1989-September 1991). The sampler was operated at 10 day regular intervals for 10 min to trap the spores. The peak season for Ganoderma is recorded from July to September with highest average monthly catch of 336 spores/m3 in September 1991 from south Delhi. Antigenic extracts were prepared from both, the spores and whole body of Ganoderma lucidum. The results of intradermal skin tests conducted on 172 patients revealed that 28.48% and 17.44% of patients showed marked skin reactivity to spore and whole body extracts, respectively. A significant correlation ($r = 0.963$, $P < 0.01$) was found between intradermal and skin-prick tests. More than 80% of the intradermal test positive patients had significantly ($P < 0.01$) elevated IgE antibodies to the fungi in question. Thus, sensitization to Ganoderma lucidum has been reported for the first time in the atopic population of India.

PMID: 7553247, UI: 96039735

Am J Chin Med 1995;**23(3-4):**289-298

Effects of Ganoderma lucidum and krestin on subset T-cell in spleen of gamma-irradiated mice.

Chen WC, Hau DM, Wang CC, Lin IH, Lee SS

Effects of Ganoderma lucidum (Gl) and Krestin (PSK) extracts on spleen, thymus and splenocytes in gamma-irradiated mice were investigated in this study. ICR strain male mice were divided into five groups. Group A was the normal control. Group B, the experimental control, was treated with Gl. Group C, the radiation treatment control, was treated with whole body exposure to 4 Gy gamma-irradiation (RT). Group D was treated with RT and Gl. Group E was treated with RT and PSK. The dosage of Gl was 400 mg/day/kg body weight and PSK was 500 mg/day/kg body weight. Our results indicated that the relative thymus weight in groups D and E were higher than group C on day 28 after gamma-irradiation. Group D was the highest in all the experimental groups. CD4 and CD8 splenocytes in group D were higher than group C on days 7 and 28. Gl was better than PSK in repairing the damage of subset T-cells in the spleen of gamma-irradiated mice.

PMID: 8571925, UI: 96126239

Am J Chin Med 1995;**23(1):**71-80

Effects of Ganoderma lucidum and krestin on cellular immunocompetence in gamma-ray-irradiated mice.

Chen WC, Hau DM, Lee SS

The effects of Ganoderma lucidum (Gl) and Krestin (PSK) extracts on cellular immunocompetence, leukocyte counts and differential count in gamma-irradiated mice were investigated in this study. ICR strain male mice were used and randomly divided into five groups. Group A is normal control. Group B, the experimental control, was treated with Gl. Group C, the radiation treatment control, was treated with whole body exposure to 4 Gy gamma-irradiation (RT). Group D was treated with RT and Gl. Group E was treated with RT and PSK. The dosage of Gl was 400 mg/day/kg body weight and PSK was 500 mg/day/kg body weight. After irradiation, six mice from each group were sacrificed on day 7 and the other six on day 28. Cellular immunocompetence was measured by means of 3H-thymidine incorporation with splenic cells stimulated through mitogens such as PHA, Con A and LPS. The results revealed that relative splenic weight in Groups D and E were higher than group C on day 28 after gamma-

irradiation, Group D was the highest in all the experimental groups. Leukocyte counts were decreased significantly in Groups D and E on day 7, the former was a little higher than the latter. Gl administration showed an increase in the leukocyte count in Group D on day 28. The blastogenic response of splenocytes to PHA and Con A in groups D and E were higher than in Group C on days 7 and 28. We suggested that Gl and PSK were effective in enhancing the recovery of cellular immunocompetence from gamma-ray irradiation.

PMID: 7598094, UI: 95321302

Am J Chin Med 1994;**22(2):**197-203

Alteration of pulse in human subjects by three Chinese herbs.

Wang WK, Chen HL, Hsu TL, Wang YY

Human subjects were fed with extract of three Chinese herbs, Panax ginseng, Panax quinquefolium roots and Ganoderma lucidum. Pulse of the radial artery was examined. Our results indicate that each herb has a specific effect on the Fourier components of the pulse, and is in agreement with traditional Chinese medical descriptions.

Publication Types:

- Clinical trial
- Randomized controlled trial

PMID: 7992821, UI: 95084985

Acta Microbiol Immunol Hung 1994;**41(1):**23-31

Some characteristics and partial purification of the Ganoderma lucidum cellulase system.

Jakucs E, Racz I, Lasztity D

The extracellular cellulase system of the white-rotting basidiomycete Ganoderma lucidum was characterised while growing in cellulose-containing shaken liquid culture. The protein content of the culture filtrate reached its maximum after 36 days and cellulase activity at about 60 days. Different cellulase activities (endoglucanase, cellobiohydrolase and beta-glucosidase) were determined in a range of pH extending from 6 to 2. All of the three enzyme activities have at least three peaks between pH 6 and 2, although optimum points of the different enzymes are slightly different, showing that the enzyme complex consists of a number of enzymes and isozymes. Partial purification of the enzyme complex was carried out by DEAE-cellulose column chromatography. Using 0-3 M linear urea gradient, protein was eluted in one sharp peak corresponding mainly to beta-glucosidase activity. Comparing crude extracellular protein with that of purified by the column using PAGE indicated that this method was suitable for the separation and partial purification of one type of Ganoderma cellulases.

PMID: 7921848, UI: 95006104

Chung Kuo Chung Hsi I Chieh Ho Tsa Chih 1993 Oct;**13(10):**613-615

[Effect of Japanese Ganoderma Lucidum on production of interleukin-2 from murine splenocytes].

[Article in Chinese]

Zhang LX, Mong H, Zhou XB

The purpose of this study was to determine the effect of Ganoderma lucidum (GL) planted in Japan on the production of Interleukin-2 (IL-2) from murine splenocytes. It was observed that hydrocortisone (HC) 0.025-1 microgram /ml could significantly antagonize the inhibitory activity of HC and CSA to increase the production of IL-2 in vitro, $P < 0.01$. When the splenocytes pretreated with GL alone or in combination with HC, it was shown that pretreatment alone had no significant effect on IL-2 production, but preincubating splenocytes with HC and GL resulted in a significant increase of IL-2 production when compared with that of HC group, $P < 0.01$. In vivo, GL 300 mg/kg could increase the production of IL-2 when oral taken GL alone or in combination of HC.

PMID: 8312700, UI: 94146512

J Tradit Chin Med 1993 Sep;**13(3):**223-226

Recent advances in studies on traditional Chinese anti-aging materia medica.

Chen K, Li C

Presented in this paper is a report of our studies on 386 traditional effective anti-aging medications, the effects of which on cell generation, survival time, immunomodulation, improvement of visceral and metabolic functions, and anti-infection, and their trace element contents were further summarized and analysed. This suggests that the investigations of traditional anti-aging materia medica in China are now well under way and some effective drugs and compound prescriptions have been explored, such as Ginseng, Radix Astragali seu Hedysari, Radix Angelicae Sinensis, Herba Epimedii, Cordyceps, Ganoderma Lucidum seu Japonicum, Radix Polygoni Multiflori, Radix Acanthopanacis Senticosi, Rhizoma Polygonati, Fructus Lycii, and Poria. However, all of these preliminary results remain to be further investigated.

Publication Types:

- Review
- Review, tutorial

PMID: 8246603, UI: 94066555

Chung Kuo Chung Yao Tsa Chih 1993 May;**18(5):**272-274

[New techniques of cultivating Ganoderma lucidum (W. Curt.:Fr)Karst.,Rev. with woodlog].

[Article in Chinese]

Cheng TQ, He XJ, Huan JH, Lin CZ, Huang DB

Imitating wild cultivation of Ganoderma lucidum with short-woodlog is a method of cultivating artificial G. lucidum developed in recent years. The method can be applied to large scale production. This paper shows that section-inoculating and impregnating with steamed shortwoodlog indoors and soil-cover cultivating under large shed are important in the cultivation.

PMID: 8216800, UI: 94030554

J Chin Med 1993;**21(1):**59-69

Evaluation of the anti-inflammatory and liver-protective effects of anoectochilus formosanus, ganoderma lucidum and gynostemma pentaphyllum in rats.

Lin JM, Lin CC, Chiu HF, Yang JJ, Lee SG

The pharmacological effects of Anoectochilus formosanus, Ganoderma lucidum and Gynostemma pentaphyllum were studied against carrageenan-induced paw edema and CC1(4)-induced hepatotoxicity in rats. The water extracts of G. pentaphyllum and G. lucidum were found to possess significant anti-inflammatory activity against carrageenan induced edema. The administration of Gynostemma pentaphyllum displayed an activity even more potent than indomethacin. In contrast, Anoectochilus formosanus showed a delayed onset of anti-inflammatory activity starting from 4 hrs post carrageenan administration. However, A. formosanus significantly decreased the acute increase in serum GOT and GPT level caused by CC1(4). Histological changes such as necrosis, fatty change, ballooning degeneration, inflammatory infiltration of lymphocytes and Kupffer cells around the central vein were simultaneously improved by the treatment of A. formosanus.

PMID: 8328423, UI: 93318804

Anticancer Res 1992 Jul;**12(4):**1211-1215

The effect of Ganoderma lucidum on induction of differentiation in leukemic U937 cells.

Lieu CW, Lee SS, Wang SY

Ganoderma (G.) lucidum is a herbal medicine with tumoricidal activity capable of inhibiting the proliferation of mouse Sarcoma 180 cells both in vitro and in vivo. In this study, we investigated the effect of the polysaccharide fraction of G. lucidum (PS-G) on the proliferation and differentiation of human monocytic leukemia cell line, U937. Using an in vitro liquid culture system, we found that the conditioned medium from PS-G-stimulated human blood mononuclear cells (PSG-MNC-CM) contained an activity that could significantly inhibit the growth of U937 cells and induce them to differentiate into mature monocytes/macrophages which had functions of phagocytosis and producing cytoplasmic superoxide. Neither PS-G nor normal (untreated) MNC-CM was found to have a differentiating effect on the target cells. The optimal condition for stimulating the in vitro production of MNC-derived differentiation-inducing activity was to use PS-G at a low concentration of 50 micrograms/ml and to incubate MNC for a short period of 24 hours. Long-term (greater than 3 days) incubation resulted in a decrease in the differentiating activity of the conditioned media.

PMID: 1503411, UI: 92368139

Chung Kuo Chung Yao Tsa Chih 1992 Apr;**17(4):**226-228

[Chemical studies on immunologically active polysaccharides of Ganoderma lucidum(Leyss. ex Fr.) Karst].

[Article in Chinese]

He Y, Li R, Chen Q, Lin Z, Xia D, Ma L

BN3B, the polysaccharide component of the fruit of Ganoderma lucidum, has been shown to have immune activity. From BN3B four homogeneous polysaccharides were separated and purified. Chemical studies on the main components BN3B1 and BN3B3 indicated that BM3B1 contained only glucose and should be a glucan containing beta-(1----6) and (1----3)glycoside bonds and that BN3B3 was an arabinogalactan containing beta-(1----6) and (1----3)glycoside bonds.

PMID: 1418551, UI: 93039591

J Nat Prod 1991 Jul;**54(4):**998-1002

Novel cytotoxic principles of Formosan Ganoderma lucidum.

Lin CN, Tome WP, Won SJ

Two new steryl esters, ergosta-7,22-dien-3 beta-yl linoleate [1] and 5 alpha,8 alpha-epidioxyergosta-6,22-dien-3 beta-yl linoleate [3], and a novel steroid, ergosta-7,22-diene- 3 beta,3 alpha,9 alpha-triol [5], have been isolated from the fruiting bodies of Formosan Ganoderma lucidum and characterized. A new lanostanoid, 3 beta-hydroxy-26-oxo-5 alpha-lanosta- 8,24-dien-11-one, and the new steroid exhibited potent inhibition of KB cells and human PLC/PRF/5 cells in vitro.

PMID: 1791484, UI: 92166830

Chung Hua I Hsueh Tsa Chih (Taipei) 1991 Jul;**48(1):**54-58

[In vitro cytotoxicity of Ganoderma lucidum on oral cancer cells].

[Article in Chinese]

Chen TW, Wong YK, Lee SS

The extract from the mycelium of Ganoderma lucidum was diluted into serial concentrations and added into in vitro cultured oral cancer and normal cell lines. After incubation for 24 hours, the survival fraction was determined by MTT colorimetric assay. The result revealed that the ID50 was about 3mg/ml and the total lethal dosage was beyond 4 mg/ml. This toxic effect was the same in both cancer and normal cells. Not only was there no difference between cancer and normal cells, but also the high dosage required in toxicity leads to the conclusion that the GL has no direct cytotoxic effect in cancer treatment.

PMID: 1653094, UI: 91356392

J Biol Chem 1991 Feb 5;**266(4):**2486-2493

Molecular cloning of a cDNA and a gene encoding an immunomodulatory protein, Ling Zhi-8, from a fungus, Ganoderma lucidum.

Murasugi A, Tanaka S, Komiyama N, Iwata N, Kino K, Tsunoo H, Sakuma S

A large amount of the novel immunomodulatory protein Ling Zhi-8 (LZ-8) is synthesized in the mycelia of Ganoderma lucidum (Kino, K., Yamashita, A., Yamaoka, K., Watanabe, J., Tanaka, S., Ko, K., Shimizu, K., and Tsunoo, H. (1989) J. Biol. Chem. 264, 472-478). A cDNA and a gene for LZ-8 were isolated and characterized. The mixed oligonucleotide probes for LZ-8 cDNA were designed from the results of protein sequencing (Tanaka, S., Ko, K., Kino, K., Tsuchiya, K., Yamashita, A., Murasugi, A., Sakuma, S., and Tsunoo, H. (1989) J. Biol. Chem. 264, 16372-16377) and were used for screening the mycelial cDNA library. The nucleotide sequence of the cloned cDNA confirms the amino acid sequence of LZ-8 that was previously determined by protein sequencing. The clones containing the LZ-8 gene (lz-8) were obtained from the mycelial genomic DNA library using the cDNA probe. Two CCAAT-like sequences and one TATA box were found at the upstream region of the postulated transcription initiation site of lz-8. A small intron (61 nucleotides long) divided lz-8 into two exons at the 5'-untranslated region. The other characteristic sequences were also found around the postulated transcription initiation site and around the poly(A) additional site.

PMID: 1990000, UI: 91115873

Yao Hsueh Hsueh Pao 1991;**26(4):**267-273

[Studies on the triterpenoid constituents of the spores from Ganoderma lucidum karst].

[Article in Chinese]

Chen RY, Yu DQ

Five compounds were isolated from the ether soluble fraction of the spores of Ganoderma lucidum. On the basis of their chemical properties and spectral data (MS, UV, IR, 1H and 13CNMR), they were identified as 3,7,11,12,15,23-hexaoxo-5 alpha-lanosta-8-en-26-oic acid (I), 3 beta,7 beta-dihydroxy-11,15,23-trioxo-5 alpha-lanosta-8-en-26-oic acid (II), 7 beta-hydroxy-3,11,15,23-tetraoxo-5 alpha-lanosta-8-en-26-oic acid (III), 3,7,11,15,23-pentaoxo-5 alpha-lanosta-8-en-26-oic acid (IV), 24,25,26-trihydroxy-5 alpha-lanosta-7,9 (11)-dien-3-one (V), Compound I is a new natural product, named ganosporeric acid A. Compounds II, III, IV and V were obtained for the first time from the spores of Ganoderma lucidum.

PMID: 1957672, UI: 92067526

Int J Immunopharmacol 1991;**13(8):**1109-1115

Immunomodulator, LZ-8, prevents antibody production in mice.

Kino K, Sone T, Watanabe J, Yamashita A, Tsuboi H, Miyajima H, Tsunoo H

LZ-8, a new and recently discovered immunomodulator from Ganoderma lucidum, has been shown to have immunosuppressive activity in vivo and to be a member of the immunoglobulin superfamily. In this paper we examined the in vivo effect of LZ-8 on antibody production using the hepatitis B surface antigen (HBs Ag) in mice. LZ-8 had mitogenic activity in vitro towards spleen cells of C57BL/10 (B10) and C57BL/10BR (B10BR) as previously shown towards those of DBA/2 mice. B10 and B10BR mice produced anti-HBs Ag antibody by the twice sensitization of the antigen while intraperitoneal administration of LZ-8 twice weekly into the mice (8 and 12 mg/kg) greatly prevented the production of antibody to HBs Ag (83.3-96.8% inhibition). We further examined the effect of LZ-8 administration on mitogen responsibility of spleen cells and on the T-cell subset population in both

the spleen and lymph node but no significant differences were observed between the LZ-8 treated and untreated mice. These results suggest that the immunosuppressive activities of LZ-8, previously shown, such as the prevention of systemic anaphylaxis and the Arthus reactions, were caused by the blocking of antigen-specific antibody production.

PMID: 1814848, UI: 92267731

Yao Hsueh Hsueh Pao 1991;**26(6):**430-436

[Application of 2d NMR techniques in the structure determination of ganosporelactone A and B].

[Article in Chinese]

Chen RY, Yu DQ

Structure and stereochemistry of ganosporelactone A and B isolated from the spores of Ganoderma lucidum have been elucidated by the use of 1H-1H COSY, 1H-13C COSY, 1H-13C COLOC and NOESY 2D NMR spectroscopy. Ganosporelactone A and B are two novel pentacyclic triterpenoids which may be biogenetically derived from lanostane skeleton through the construction of C16 and C23 bond.

PMID: 1789109, UI: 92160515

Chem Pharm Bull (Tokyo) 1990 May;**38(5):**1359-1364

Cardiovascular effects of mycelium extract of Ganoderma lucidum: inhibition of sympathetic outflow as a mechanism of its hypotensive action.

Lee SY, Rhee HM

In an effort to understand the mechanism of cardiovascular actions of Ganoderma lucidum which was cultivated in Korea, the mycelium was isolated for a large-scale culture. Water extract of the mycelia was evaluated for its cardiovascular activity in anesthetized rabbits and rats. The left femoral artery and vein were cannulated for the measurement of arterial pressure and subsequent delivery of drugs. The left kidney was exposed retroperitoneally and a branch of the renal nerve was used to integrate renal efferent or afferent nerve activities. The extract decreased systolic and diastolic blood pressure, which was accompanied by an inhibition of renal efferent sympathetic nerve activity. The extract did not decrease heart rate in these animals, although there was clear hypotension in the extract dose dependent manner. This suggests that the hypotension induced by the treatment of the extract was secondary to the primary effect of the extract in the central nerve system, which suppressed the sympathetic outflow. Therefore we concluded that the mechanism of hypotensive action of Ganoderma lucidum was due to its central inhibition of sympathetic nerve activity.

PMID: 2393962, UI: 90367209

Am J Chin Med 1990;**18(3-4):**175-179

The lack of antiplatelet effect of crude extracts from ganoderma lucidum

on HIV-positive hemophiliacs.

Gau JP, Lin CK, Lee SS, Wang SR

Effects of the extracts from Ganoderm lucidum (GL-P) to influence immune status of the hemophiliacs with positive HIV antibody and reversed helper/suppressor T-lymphocyte ratio were studied. Since the extracts from G. lucidum have been reported to contain high levels of adenosine, the untoward antiplatelet effect of the extracts on hemophiliacs were highly concerned. Five patients of hemophilia A voluntarily received the extracts which has been analyzed to contain 150 mg of adenosine in 100 gm of the extracts. Patients were estimated to take 1.35 mg of the adenosine daily. Platelet aggregation tests before and after the trial of the extracts showed no significant change. Our crude extracts of the Ganoderma lucidum was considered not to have untoward antiplatelet effect in vivo despite the high contents of adenosine.

PMID: 2270852, UI: 91103217

Am J Chin Med 1990;**18(1-2):**61-69

Radioprotective effect of Ganoderma lucidum (Leyss. ex. Fr.) Karst after X-ray irradiation in mice.

Hsu HY, Lian SL, Lin CC

Six to seven week old male mice of ICR strain were exposed to 500 or 650 cGy of X-ray during experiments to determine if Ganoderma lucidum could be a factor in modification of radiation damage. Continuous intraperitoneal injection of the extract from Ganoderma lucidum before or after irradiation of 500 and 650 cGy of X-ray was found to improve the 30-day survival fractions of ICR mice, but wasn't significant by statistical analysis. The administration also enhanced the recoveries of the body weights and increased the recovery of hemograms of irradiated mice from radiation damage by injecting before or after radiation exposure, especially for the treatment of 500 cGy irradiation. The 10-day CFUs was significantly higher for Ganoderma lucidum treated groups than for untreated groups. However, the differences of radioprotective effect between the X-ray irradiated groups with Ganoderma lucidum pretreated and post-treated were not significant (p greater than 0.05).

PMID: 2239816, UI: 91051379

J Tongji Med Univ 1990;**10(4):**240-243

Experimental and clinical studies on inhibitory effect of ganoderma lucidum on platelet aggregation.

Tao J, Feng KY

In this study we observed the inhibitory effect of Chinese herbal medicine Ganoderma lucidum (GL) on platelet aggregation in 15 healthy volunteers and 33 patients with atherosclerotic diseases. The results showed that the first and the second phase of aggregation of platelets of the healthy volunteers were obviously inhibited (P less than 0.01) when watery soluble extract of GL of different concentrations was added to the platelets in vitro, i. e., the reaction speed of platelet aggregation was slowed down. The inhibitory effect was related to dosage. Platelet aggregation induced by ADP in final concentration of 2 mumol/L and 3 mumol/L was obviously inhibited, after the patients had taken GL 1 g 3 times a day for 2 weeks, the maximum platelet aggregation inhibition rates were then 31.49% (P less than 0.01) and 17.7% (P less than 0.01) respectively. Length and weights (wet and dry) of the

extracorporeal thrombi were reduced from 30.05 +/- 4.38 mm, 103.9 +/- 9.33 mg and 44.89 +/- 4.79 mg to 20.4 +/- 2.33 mm (P less than 0.05), 85.27 +/- 8.77 mg (P less than 0.01) and 35.1 +/- 4.5 mg (P less than 0.01) respectively after oral administration of GL. The results of our experiments suggested that the Chinese herbal medicine GL may be an effective inhibitory agent of platelet aggregation. However, its mechanism and active principles remain to be further investigated.

PMID: 2098581, UI: 91278149

Planta Med 1989 Oct;**55(5):**423-428

Mechanisms of hypoglycemic activity of ganoderan B: a glycan of Ganoderma lucidum fruit bodies.

Hikino H, Ishiyama M, Suzuki Y, Konno C

Ganoderan B increased the plasma insulin level in normal and glucose-loaded mice but elicited no effect on insulin binding to isolated adipocytes. Administration of ganoderan B elicited significant increases of the activities of hepatic glucokinase, phosphofructokinase and glucose-6-phosphate dehydrogenase, decreased the hepatic glucose-6-phosphate and glycogen synthetase activities and did not affect the activities of hexokinase and glycogen phosphorylase. Ganoderan B reduced the glycogen content in the liver but had no influence on total cholesterol and triglyceride levels in the plasma and liver.

PMID: 2682700, UI: 90047198

Planta Med 1989 Aug;**55(4):**385

Hypoglycemic actions of some heteroglycans of Ganoderma lucidum fruit bodies.

Hikino H, Mizuno T

PMID: 2813573, UI: 90047191

J Pharmacobiodyn 1989 Feb;**12(2):**118-123

Antitumor activity of Sarcodon aspratus (Berk.) S. Ito and Ganoderma lucidum (Fr.) Karst.

Maruyama H, Yamazaki K, Murofushi S, Konda C, Ikekawa T

Antitumor activity of Sarcodon aspratus (Berk.) S. Ito and Ganoderma lucidum (Fr.) Karst. was investigated. Methanol and aqueous extracts of these Japanese mushrooms were tested for antitumor activity against solid type of sarcoma 180 by intraperitoneal or oral administration. The aqueous extract was remarkably effective for inhibition of tumor growth, but the methanol extract was not. The fraction of molecular weight more than 10000 had a high inhibitory activity against the tumor growth, but the fraction of molecular weight less than 10000 did not. Fractionation was carried out by using an ion-exchanger, and fraction S-4 having the highest carbohydrate content had the highest antitumor activity by intraperitoneal administration.

PMID: 2746451, UI: 89310892

Chem Pharm Bull (Tokyo) 1989 Feb;**37(2):**531-533

Ganoderic acid and its derivatives as cholesterol synthesis inhibitors.

Komoda Y, Shimizu M, Sonoda Y, Sato Y

Oxygenated lanosterol derivatives, which were isolated from Ganoderma lucidum (Polyporaceae) or their derivatives obtained by chemical conversion, were tested for their effect on cholesterol biosynthesis from 24,25-dihydrolanosterol by rat hepatic subcellular 10,000 x g supernatant fraction. The sterol (VI, 40 microM) with 7-oxo and 15 alpha-hydroxy groups potently inhibited the synthesis of cholesterol from [24,25-3H]-24,25-dihydrolanosterol (18 microM).

PMID: 2743504, UI: 89304236

Vopr Pitan 1989 Jan;**1:**16-19

[Anti-atherosclerotic properties of higher mushrooms (a clinico-experimental investigation)].

[Article in Russian]

Li Khva Ren, Vasil'ev AV, Orekhov AN, Tertov VV, Tutel'ian VA

Antiatherosclerotic properties of water and alcoholic extracts of 20 types of high-species mushrooms were investigated by evaluation of intracellular cholesterol accumulation and 3H-thymidine inclusion into the cells of the human aortal intima in culture. The influence of a single intake of some mushroom species on antiatherosclerotic properties of the human sera was studied. It has been shown that Ganoderma lucidum and Lentinus edodes possess pronounced antiatherosclerotic properties.

PMID: 2718411, UI: 89243251

J Nutr Sci Vitaminol (Tokyo) 1988 Aug;**34(4):**433-438

Dietary effect of Ganoderma lucidum mushroom on blood pressure and lipid levels in spontaneously hypertensive rats (SHR).

Kabir Y, Kimura S, Tamura T

PMID: 3236086, UI: 89177594

Planta Med 1988 Aug;**54(4):**290-294

Effects of the extracts of Ganoderma lucidum on blood glucose level in rats.

Kimura Y, Okuda H, Arichi S

PMID: 3222371, UI: 89129171

Agents Actions 1988 Apr;**23(3-4):**157-160

Anti-allergic constituents in the culture medium of Ganoderma lucidum. (II). The inhibitory effect of cyclooctasulfur on histamine release.

Tasaka K, Mio M, Izushi K, Akagi M, Makino T

For centuries, Ganoderma lucidum has been used in Oriental medicine for the treatment of chronic bronchitis. Sequential fractions of the culture medium of this plant revealed that one of the active constituents was cyclooctasulfur. The latter effectively inhibited histamine release from rat peritoneal mast cells and impeded 45Ca uptake into these cells without affecting the cyclic AMP content. SDS-PAGE analysis indicated that cyclooctasulfur induced some changes in protein bands obtained from the membrane fraction of mast cells, suggesting that this compound interacts with membrane proteins so as to inhibit 45Ca uptake, and that this may be the main cause of histamine release inhibition.

PMID: 2455976, UI: 88279189

Agents Actions 1988 Apr;**23(3-4):**153-156

Anti-allergic constituents in the culture medium of Ganoderma lucidum. (I). Inhibitory effect of oleic acid on histamine release.

Tasaka K, Akagi M, Miyoshi K, Mio M, Makino T

The chloroform extract from Ganoderma lucidum broth markedly inhibited histamine release from rat peritoneal mast cells. From the active fractions, palmitic acid, stearic acid, oleic acid and linoleic acid were isolated. Oleic acid dose-dependently inhibited the histamine release and 45Ca uptake into mast cells induced by compound 48/80 and A-23187 at concentrations of 5 to 50 microM and 0.5 to 5 microM, respectively. Saturated fatty acids, however, had only a weak inhibitory effect on histamine release. Although linoleic acid and linolenic acid effectively prevented this release, these two compounds caused marked release at concentrations higher than 10 microM and 20 microM, respectively. Oleic acid induces membrane-stabilization in model membrane systems. It was concluded that one of the effective constituents obtainable from the chloroform extract of G. lucidum-cultured broth is oleic acid.

PMID: 2455975, UI: 88279188

Int Arch Allergy Appl Immunol 1988;**85(2):**161-166

Basidiospore extracts: evidence for common antigenic/allergenic determinants.

O'Neil CE, Hughes JM, Butcher BT, Salvaggio JE, Lehrer SB

Spore extracts, prepared from Armillariella tabescens, Pleurotus ostreatus, Coprinus quadrifidus, Amanita

muscaria, Ganoderma lucidum, Psilocybe cubensis, Pisolithus tinctorius, Scleroderma sp. and Calvatia cyathiformis, were examined for antigenic/allergenic relationships by Ouchterlony and radioallergosorbent testing (RAST) inhibition, respectively. Ouchterlony, using hyperimmunized rabbit sera, demonstrated a high degree of cross-antigenicity among the extracts tested; however, some unique antigens were also present. RAST inhibition, evaluated by comparing extract concentrations which inhibited the RAST by 50% (IC-50), varied with the allergen tested. P. cubensis was the most potent inhibitor (IC-50 ranged from 0.034 mg/ml for A. tabescens RAST to 0.29 mg/ml for G. lucidum RAST). P. tinctorius was the least potent inhibitor, failing to reach IC-50 at 10 mg/ml for any basidiospore extract. Evaluation of slopes and intercepts of the dose-response lines demonstrated qualitative and quantitative differences among allergens in these extracts. These results indicate the presence of shared allergenic epitopes, and suggest that representative extract panels could be developed for future use in diagnosis and treatment of basidiospore-sensitive individuals.

PMID: 2448249, UI: 88114101

J Chromatogr 1987 Nov 20;**410(1):**195-200

Separation of oxygenated triterpenoids from Ganoderma lucidum by high-performance liquid chromatography.

Lin LJ, Shiao MS

PMID: 3429550, UI: 88115730

Chung Hua Chung Liu Tsa Chih 1987 Mar;**9(2):**109-111

[Effect of six edible plants on the development of AFB1-induced gamma-glutamyltranspeptidase-positive hepatocyte foci in rats].

[Article in Chinese]

Chen ZY, Yan RQ, Qin GZ, Qin LL

Six edible plants, green tea (GT), black tea (BT), Lentinus edodes (berk) Sing (LE), Hericium erinaceus (Bull. ex Fr.) Pers. (HE), Mixture of Ganoderma Lucidum (Ley ss ex Fr.) Karst et Ganoderma Japanium (Fr.) Lloyd (MGLJ) and mung bean (MB), were tested for the effect on the development of AFB1-induced gamma-glutamyltranspeptidase positive hepatocyte foci (gamma-GT foci) using an in vivo short-term test model in rats. The rats received intraperitoneally 12 doses of initiator AFB1, 400 micrograms/kg per dose for 2 successive weeks. Two weeks after the initiation, the rats were submitted to a modified "Solt-Farber promotion program", i.e., a two weeks' feeding of a diet containing 0.015% acetylaminofluorene plus a two-third partial hepatectomy (PH) on day 7. The rats were sacrificed 10 days after PH and the livers were processed to gamma-glutamyltranspeptidase staining. The tested substances were powdered and mixed with the basal diet at the concentration level of 30% for MB and 5% for the others. The rats were fed with the diet-containing tested substances from 10 days before the AFB1 initiation to 3 days after the AFB1 conclusion. Consequently, the liver of the rats which had consumed GT showed significantly less and smaller gamma-GT foci, and those which had consumed BT, HE and LE showed somewhat less and significantly smaller foci than the control groups. It is indicated that the four diets have an inhibiting effect on AFB1-induced gamma-GT foci in different degrees. MB and MGLJ show no significant influence on the foci.

PMID: 2443327, UI: 88003983

J Nat Prod 1986 Jul;**49(4):**621-625

Three new lanostanoids from Ganoderma lucidum.

Arisawa M, Fujita A, Saga M, Fukumura H, Hayashi T, Shimizu M, Morita N

Three new lanostanoids--ganodermenonol (1), ganodermadiol (2), and ganodermatriol (3) [isolated as its triacetate derivative (3a)]--were isolated from the MeOH extract of Ganoderma lucidum, together with ergosterol and its peroxide. The new compounds were identified as 26-hydroxy-5 alpha-lanosta-7,9(11),24-trien-3-one (1), 5 alpha-lanosta-7,9(11),24-triene-3 beta, 26-diol (2), and 5 alpha-lanosta-7,9(11),24-triene-3 beta, 26,27-triol (3) by their respective spectral data.

PMID: 3783158, UI: 87059872

Yakugaku Zasshi 1986 Jul;**106(7):**600-604

[Studies on Ganoderma lucidum. VII. Anti-allergic effect. (2)].

[Article in Japanese]

Nogami M, Ito M, Kubo M, Takahashi M, Kimura H, Matsuike Y

PMID: 3772731, UI: 87036327

Chem Pharm Bull (Tokyo) 1986 Jul;**34(7):**3025-3028

Angiotensin converting enzyme-inhibitory triterpenes from Ganoderma lucidum.

Morigiwa A, Kitabatake K, Fujimoto Y, Ikekawa N

PMID: 3021351, UI: 87028440

Yakugaku Zasshi 1986 Jul;**106(7):**594-599

[Studies on Ganoderma lucidum. VI. Anti-allergic effect. (1)].

[Article in Japanese]

Nogami M, Tsuji Y, Kubo M, Takahashi M, Kimura H, Matsuike Y

PMID: 2877078, UI: 87036326

Yakugaku Zasshi 1985 Oct;**105(10):**942-947

[Studies on Ganoderma lucidum. I. Efficacy against hypertension and side effects].

[Article in Japanese]

Kanmatsuse K, Kajiwara N, Hayashi K, Shimogaichi S, Fukinbara I, Ishikawa H, Tamura T

PMID: 4093855, UI: 86143370

Planta Med 1985 Aug;**4:**339-340

Isolation and hypoglycemic activity of ganoderans A and B, glycans of Ganoderma lucidum fruit bodies.

Hikino H, Konno C, Mirin Y, Hayashi T

PMID: 3840903, UI: 86068519

Chem Pharm Bull (Tokyo) 1985 Jul;**33(7):**3012-3015

Isolation of an inhibitor of platelet aggregation from a fungus, Ganoderma lucidum.

Shimizu A, Yano T, Saito Y, Inada Y

PMID: 4085058, UI: 86106360

Chem Pharm Bull (Tokyo) 1985 Apr;**33(4):**1367-1374

The biologically active constituents of Ganoderma lucidum (Fr.) Karst. Histamine release-inhibitory triterpenes.

Kohda H, Tokumoto W, Sakamoto K, Fujii M, Hirai Y, Yamasaki K, Komoda Y, Nakamura H, Ishihara S, Uchida M

PMID: 2412714, UI: 86002462

J Tradit Chin Med 1985 Mar;**5(1):**55-60

Study of the action of Ganoderma lucidum on scavenging hydroxyl radicals from plasma.

Wang JF, Zhang JJ, Chen WW

PMID: 2993758, UI: 85294581

Tokyo Ika Shika Daigaku Iyo Kizai Kenkyusho Hokoku 1985;**19:**45-54

[Nuclear magnetic resonance spectra of terpenoid constituents and their derivatives of Ganoderma lucidum].

[Article in Japanese]

Komoda Y

PMID: 3869716, UI: 86234682

Yakugaku Zasshi 1983 Aug;**103(8):**871-877

[Ganoderma lucidum. (4) Effects on disseminated intravascular coagulation].

[Article in Japanese]

Kubo M, Matsuda H, Nogami M, Arichi S, Takahashi T

PMID: 6663465, UI: 84114316

J Tradit Chin Med 1982 Mar;**2(1):**63-65

The clinical effects of Ganoderma lucidum spore preparations in 10 cases of atrophic myotonia.

Fu HD, Wang ZY

PMID: 6765691, UI: 90065640

Chem Pharm Bull (Tokyo) 1981 Dec;**29(12):**3611-3616

Studies on fungal polysaccharides. XXVII. Structural examination of a water-soluble, antitumor polysaccharide of Ganoderma lucidum.

Miyazaki T, Nishijima M

PMID: 7340947, UI: 82184494

Chin Med J (Engl) 1979 Jul;**92(7):**496-500

Some pharmacological actions of the spores of Ganoderma lucidum and the mycelium of Guanoderma capense (Lloyd) Teng cultivated by submerged fermentation.

Gengtao L, Tiantong B, Xinyi N, Shuzhen L, Zhenyu S

PMID: 114375, UI: 80023763

Yao Hsueh Hsueh Pao 1979;**14(5):**284-287

[Some pharmacological actions of Ganoderma lucidum and G. japonicum (FR) Llyod on mouse liver].

[Article in Chinese]

Liu GT, Bao TT, Wei HL, Song ZY

PMID: 506728, UI: 80061835

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2 citations found Ganoderma japonicus

J Pharmacobiodyn 1983 Dec;**6(12):**983-990

Polysaccharides in fungi. XIV. Anti-inflammatory effect of the polysaccharides from the fruit bodies of several fungi.

Ukai S, Kiho T, Hara C, Kuruma I, Tanaka Y

Anti-inflammatory assays on the carrageenin-induced edema and scald-induced hyperalgesia in the hindpaw of rats were studied on polysaccharides obtained from the fruit bodies of various fungi (polysaccharide AC, BC: Tremella fuciformis;MEA, MHA, MCW-A, MCW-N: Auricularia auricula-judae; T-2-HN: Dictophora indusiata;G-A: Ganoderma japonicum). The purified polysaccharides MHA, MCW-A, G-A and T-2-HN exhibited a significant inhibitory effect on carrageenin edema. Among these polysaccharides, T-2-HN (partially O-acetylated alpha-D-mannan) also showed the marked inhibitory effect on scald hyperalgesia. We have found that T-2-HN has more potent anti-inflammatory activity than phenylbutazone in the above two inflammatory models. Since the purified polysaccharide is free from protein and lipid, it is clear that anti-inflammatory effect arises from the polysaccharide itself. The polysaccharides (T-2-HN, locust bean gun, xanthan gum) had little effect on the metabolism of arachidonic acid in canine platelets. The mechanism of the anti-inflammatory activity of the polysaccharide remains obscure.

PMID: 6425490, UI: 84187999

Chem Pharm Bull (Tokyo) 1983 Feb;**31(2):**741-744

Polysaccharides in fungi. XIII. Antitumor activity of various polysaccharides isolated from Dictyophora indusiata, Ganoderma japonicum, Cordyceps cicadae, Auricularia auricula-judae, and Auricularia species.

Ukai S, Kiho T, Hara C, Morita M, Goto A, Imaizumi N, Hasegawa Y

PMID: 6883594, UI: 83285550

Pour joindre le site originale cliquez sur la barre ci-dessus

35 citations found

Biol Pharm Bull 1997 Jul;**20(7):**781-785

Anti-hyperliposis effect of maitake fruit body (Grifola frondosa). I.

Kubo K, Nanba H

Experimental rat models (5-week-old Sprague-Dawley rats) with hyperlipemia were prepared by feeding high-cholesterol feed containing sodium cholate and casein as a protein source. Dried maitake (Grifola frondosa) powder was mixed with the basic high-cholesterol feed and the serum lipids were periodically measured. Values of cholesterol, triglyceride and phospholipid in serum of rats in the maitake-feed group were suppressed by 0.3-0.8 times those in animals fed the basic feed, the latter values being close to those in rats given normal feed. The value of high density lipoprotein (HDL)-cholesterol in serum which is generally reduced by the ingestion of high-cholesterol feed remained the level it was at the beginning of the experiment. Weights of extirpated liver and epididymal fat-pads were significantly less (0.6-0.7 times) than those in the basic feed group, indicating that maitake inhibits lipid accumulation in the body. Liver lipids were also measured and the values were found to be decreased by maitake administration as true of serum lipid, suggesting maitake has an anti-liver lipid activity. Measurement of the amount of total cholesterol and bile acid in feces showed, the ratio of cholesterol-excretion had increased 1.8 times and bile acid-excretion 3 fold by maitake treatment. From these results, it is believed that maitake helps to improve the lipid metabolism as it inhibits both liver lipid and serum lipid which are increased by the ingestion of high-fat feed.

PMID: 9255420, UI: 97399293

Immunopharmacol Immunotoxicol 1997 May;**19(2):**175-183

Effects of Lentinus edodes, Grifola frondosa and Pleurotus ostreatus administration on cancer outbreak, and activities of macrophages and lymphocytes in mice treated with a carcinogen, N-butyl-N-butanolnitrosoamine.

Kurashige S, Akuzawa Y, Endo F

ICR mice were treated with a carcinogen, N-butyl-N'-butanolnitrosoamine BBN), every day for 8 consecutive weeks and the effects of oral administration of edible mushrooms on the induction of urinary bladder carcinoma and on the activities of macrophages and lymphocytes were studied. Bladder carcinoma were found in all 10 mice (100%) treated with BBN alone, while we observed carcinoma only in 9 of 17 mice (52.9%), in 7 of 15 mice (46.7%) and 13 of 20 mice (65.0%) treated with Lentinus edodes, Grifola frondosa and Pleurotus ostreatus, respectively. Chemotactic activity of macrophages was suppressed in mice treated with BBN alone but maintained almost the normal level in mice treated with BBN plus Lentinus, Grifola or Pleurotus. Lymphocytes collected from

mice treated with BBN plus each mushroom showed almost normal blastogenic response against concanavalin A, although those from mice treated with BBN alone completely retarded their response. Cytotoxic activity of lymphocytes against Yac-1 cells was also maintained at a normal level in mice treated with BBN plus each mushroom. Whereas in mice treated with BBN alone significant depression of NK cell activity occurred. Significantly higher cytotoxic activity against P-815 cells was observed in lymphocytes from mice treated with BBN plus each mushroom than that in lymphocytes from normal mice or mice treated with BBN alone.

PMID: 9130004, UI: 97276251

Biol Pharm Bull 1996 Apr;**19(4):**608-612

Effect of beta-glucans on the nitric oxide synthesis by peritoneal macrophage in mice.

Ohno N, Egawa Y, Hashimoto T, Adachi Y, Yadomae T

Nitric oxide (NO) is an important effector molecule on antimicrobial and antitumor effects of macrophages. (1 -> 3)-beta-D-Glucan (beta-glucan) is well known to show various immunopharmacological effects such as antimicrobial effect and antitumor effect by activating various points of host defense mechanisms. This paper deals with NO synthetic activity of peritoneal macrophage (PM) induced by beta-glucan administration in mice. The activity was determined by measuring NO concentration in PM culture by Griess reagent after 24 or 48 h in vitro culture. Administration (i.p. or i.v.) of a branched soluble (1 -> 3)-beta-D-glucan, grifolan (GRN), from Grifola frondosa enhanced NO synthesis of PM dose and time dependently. The activity was abrogated by the addition of N(G)-monomethyl-L-arginine (L-NMMA) in vitro. The most significant activity was observed at 3-7 d after the administration of GRN (250 mu g/mouse). PM from all strains of ICR, C3H/HeN, C3H/HeJ, BALB/c, BALB/c nu/nu, C57BL, and AKR mice showed significant activity by GRN administration. Among beta-glucans tested, SSG and OL-2, highly branched soluble glucans, and a particulate beta-glucan, zymosan, showed similar activity. Addition of GRN directly to in vitro RAW 264.7 or proteose peptone induced peritoneal macrophage (PP-PEC) culture could not enhance NO synthesis. However, NO synthesis of PP-PEC was enhanced in vitro by addition of GRN in the presence of interferon gamma (IFN gamma). Gene expression of IFN gamma mRNA in the liver and PEC were enhanced in GRN administered mice assessed by reverse transcriptase assisted PCR (RT-PCR) method. These facts strongly suggested that beta-glucan has capacity to enhance NO synthesis of PM in vivo through IFN gamma mediated mechanism.

PMID: 8860968, UI: 97014133

FEMS Immunol Med Microbiol 1996 Jan;**13(1):**51-57

Blood clearance of (1-->3)-beta-D-glucan in MRL lpr/lpr mice.

Miura NN, Ohno N, Aketagawa J, Tamura H, Tanaka S, Yadomae T

(1-->3)-beta-D-Glucans have a variety of biological and immunopharmacological properties, and they are used clinically as biological response modifiers (BRMs). Clinically, these glucans have often been used for long periods by multiple dosing. During studies on the clearance and metabolism of the glucans in mice, we have found that, in the case of a single dose, the glucan was cleared from blood eventually, and remained constant in the organs for at least one month. Here, we investigated the clearance of glucans from the blood following multiple dosing using MRL lpr/lpr mice with an autoimmune disease. Two kinds of glucans, GRN from Grifola frondosa and SSG from Sclerotinia sclerotiorum, were administered to the mice once a week for more than 35 weeks (250 micrograms/week/mouse by the intraperitoneal route). Examination of the blood clearance of the glucans in these mice revealed that the glucan concentrations were always high (about 20 micrograms/ml for GRN and 200

micrograms/ml for SSG). It is also shown that the glucans were significantly deposited in the liver and spleen of these mice. These findings suggest that administration of a large quantity of the glucan saturated the reticuloendothelial system, resulting in circulation of the glucan in the blood.

PMID: 8821398, UI: 96418613

J Biochem (Tokyo) 1995 Nov;**118(5):**1014-1020

Characterization of a thermostable lysine-specific metalloendopeptidase from the fruiting bodies of a basidiomycete, Grifola frondosa.

Nonaka T, Ishikawa H, Tsumuraya Y, Hashimoto Y, Dohmae N

A zinc-metalloendopeptidase, MEP, capable of catalyzing specific cleavage of acyl-lysine bonds (-X-Lys-) in polypeptides has been purified 212-fold in a yield of 24.7% from the fruiting bodies of Grifola frondosa, which is a popular edible mushroom called "MAITA-KE" in Japan. The purified enzyme consists of a single polypeptide chain with an apparent molecular mass of 20 kDa and a pI value of 7.46, contains 1 atom of zinc/molecule and can be inactivated with EDTA or 1,10-phenanthroline. Treatment of MEP with EDTA affords an apoenzyme, whose activity can be fully restored by the addition of Mn2+, Zn2+, Ca2+, or Co2+. Prominent features of MEP are its remarkable heat stability and its high affinity for beta-D-glucans and chitin. It hydrolyzes proteins maximally at pH 9-10, liberating only lysylpeptides. Polylysine and lysine copolymers with alanine, phenylalanine, or glutamic acid can serve as good substrates. Lysylalanine was liberated from bovine insulin and its oxidized B chain by the action of MEP. Mass spectrometric analysis by Frit-FAB MS of the fragments generated from horse heart cytochrome c presented unambiguous evidence to corroborate the specificity of MEP for acyl-lysine bonds.

PMID: 8749321, UI: 96318516

Biol Pharm Bull 1995 Oct;**18(10):**1320-1327

Structure-activity relationship of (1-->3)-beta-D-glucans in the induction of cytokine production from macrophages, in vitro.

Okazaki M, Adachi Y, Ohno N, Yadomae T

In a previous study, we reported that one of the gel-forming (1-->3)-beta-D-glucans, grifolan (from Grifola frondosa, GRN), stimulated cytokine production from macrophages in vitro. However, several other gel-forming (1-->3)-beta-D-glucans, such as sonifilan (SPG) and SSG, did not induce cytokine production from macrophages. The ultrastructure of gel-forming (1-->3)-beta-D-glucans, especially the triple- and single-helix, does not affect the cytokine-inducing activity. The action on tumor necrosis factor alpha (TNF alpha) release was correlated with the molecular weight of GRN, since the highest molecular weight fraction of GRN, Mr > or = 45000, exhibited the strongest activity. Although, native SSG (Mr > or = 2000000) did not induce cytokine production, chemical modification involving debranching of the side chain glucosyl residues of SSG resulted in TNF alpha inducing activity. These results suggest that the branching ratio and molecular weight of (1-->3)-beta-D-glucans are important factors for the production of cytokines from macrophages. GRN-inducible TNF alpha release was reduced by co-culturing with SPG, SSG, or the soluble beta-glucan, laminarin (LAM). Pretreatment alone with SPG or LAM was not sufficient for significant inhibition of GRN-inducible TNF alpha release. TNF alpha production induced with 50 micrograms/ml of zymosan (ZyM) was also reduced by addition of SPG, but TNF alpha production, stimulated with a higher concentration (100 micrograms/ml) of ZyM or with lipopolysaccharide (LPS), was not reduced significantly. The inhibitory effect of LAM on the uptake of GRN by RAW264.7 cells was not completely correlated with TNF alpha release. These results suggest that macrophages may incorporate

beta-glucans through certain (1-->3)-beta-D-glucan-specific mechanisms and/or other endocytosis pathways, and that the beta-glucan-specific route is partially associated with cytokine production. In conclusion, TNF alpha release by macrophages is induced only by beta-glucans with high molecular weights and lower branching ratios, and the mechanism for the recognition of beta-glucans is multiple and assumed to be divided into several parts involving various cellular functions.

PMID: 8593430, UI: 96154438

Biol Pharm Bull 1995 Jan;**18(1):**126-133

Enhancement of LPS triggered TNF-alpha (tumor necrosis factor-alpha) production by (1-->3)-beta-D-glucans in mice.

Ohno N, Asada N, Adachi Y, Yadomae T

Effects of (1-->3)-beta-D-glucans on tumor necrosis factor-alpha (TNF-alpha) production in mice in vivo were investigated with or without triggering stimulation of lipopolysaccharide (LPS). Administration of grifolan (GRN) (100-250 micrograms/mouse) obtained from Grifola frondosa, did not elevate the TNF-alpha concentration in serum, but significantly elevated LPS (10 micrograms/mouse)-elicited TNF-alpha production in serum. The priming effect was observed as early as 2 h after administration and remained high for 3 weeks. The priming effect was dependent on the strain of mice, i.e. ICR, BALB/c, and MRL/lpr (15 weeks old) showed high response. In addition, GRN administration increased membrane-bound TNF-alpha assessed by Western blotting and flow cytometry. Comparing the activity using structurally related glucans obtained from other microorganisms, highly branched glucans, SSG isolated from Sclerotinia sclerotiorum IFO 9395 and OL-2 from Omphalia lapidescence significantly increased TNF-alpha production. Small molecular weight GRN derivatives prepared by heat degradation method showed weaker priming effect. These facts suggested that the glucans showed priming effect of TNF-alpha production in vivo and that this effect was related to the degree of branching and molecular weight.

PMID: 7735226, UI: 95253138

Biol Pharm Bull 1994 Dec;**17(12):**1554-1560

Enhancement of cytokine production by macrophages stimulated with (1-->3)-beta-D-glucan, grifolan (GRN), isolated from Grifola frondosa.

Adachi Y, Okazaki M, Ohno N, Yadomae T

The ability of grifolan (GRN), a purified fungal (1-->3)-beta-D-glucan, to induce various cytokines from macrophages was examined in vitro. Interleukin-6 (IL-6) activity in supernatants from the culture of macrophage cell line, RAW264.7 was dependent on increasing doses of GRN. The level of IL-6 induced with 500 micrograms/ml of GRN was comparable to that induced with lipopolysaccharide (LPS) 10 micrograms/ml. Enhancement of the mRNA level of IL-6 by treatment with GRN was detected by reverse transcriptase-polymerase chain reaction (RT-PCR). The effect of GRN on production of IL-6 was also observed using peritoneal macrophages from C3H/HeJ mice which did not respond to endotoxins. This data suggested that the ability of GRN to activate IL-6 production of macrophages is not due to contamination of endotoxins in the preparation. Enhanced production of cytokine by GRN was observed not only with IL-6, but also with interleukin-1 (IL-1) and tumor necrosis factor alpha (TNF alpha). In the production of TNF alpha, GRN was more effective than LPS used in this study. Other soluble or gel-forming(1-->3)-beta-D-glucans from various sources did not enhance the production of such cytokines although they are structurally similar to GRN. The above results indicate that GRN is a novel macrophage activator which augments cytokine production without dependence on endotoxins.

PMID: 7537572, UI: 95253105

Biol Pharm Bull 1994 Aug;**17(8):**1106-1110

Anti-diabetic activity present in the fruit body of Grifola frondosa (Maitake). I.

Kubo K, Aoki H, Nanba H

The fruit body of Grifola frondosa (maitake), Basidiomycetes was confirmed to contain substances with anti-diabetic activity. When 1 g/d of powdered fruit body of maitake was given orally to a genetically diabetic mouse (KK-Ay), blood glucose reduction was observed, in contrast to the control group in which the blood glucose increased with ageing. Moreover, levels of insulin and triglyceride in plasma demonstrated a change similar to blood glucose with feeding of maitake. Ether-ethanol-soluble (ES) and hot water-soluble (WS) fractions were prepared from the fruit body and their hypoglycemic activity was examined. Blood glucose-lowering activity was found when ES-fraction or WS-50% ethanol float (X) fraction was administered orally, but other WS-fractions were inactive. These results suggest that the anti-diabetic activity was present not only in the ES-fraction consisting of lipid but also in the X-fraction of peptidoglycan (sugar:protein = 65:35).

PMID: 7820117, UI: 95119980

Chung Hua Yu Fang I Hsueh Tsa Chih 1994 May;**28(3):**147-150

[Inhibitory effects of fifteen kinds of Chinese herbal drugs, vegetables and chemicals on SOS response].

[Article in Chinese]

Jin ZC, Qian J

Effects of 15 kinds of herbal drugs, vegetables and chemicals on lex-dependent sfi-SOS response were determined by micropersistent and/or pulse models induced by 4-Nitroquinoline-N-oxide (4NQO) and Mitomycin C (MMC) in Escherichia coli(E. coli) PQ37 and PQ35, respectively. Results showed the water extract of Rhizoma Polygonati (RP), Fructus Chebulae (FC), Radix Polygoni Multiflori (RPM), Fructus Ligustri Lucidi (FLL), Bulbus Fritillariae Thunbergii (BFT), shell of water chestnut with a pedicle, Chinese chives juice, and solutions of 5-Fluorouracil, Tannic acid and garlicin could inhibit SOS responses with a dose-response relationship and suggested the inhibitory effects took place both inside and outside E. coli cells. Water extract of FC, FLL, BFT, shell of water chestnut with a pedicle, Chinese chives juice and solution of 5-Fluorouracil and Tannic acid could intracellularly inhibit SOS responses induced by MMC in E. coli PQ35, and acetone extract of Grifola Frondosa (GF) could extracellularly inhibit SOS responses in E. coli PQ37 and intracellularly in PQ35 induced by 4NQO or MMC. Water extract of raw hawthorn. Radix Angelicae Duhuricae (RAD), Radix Ophiopogonis (RO), and 5-Fluorodeoxyuridine could extracellularly inhibit SOS responses induced by 4NQO in E coli PQ37. The possible mechanisms of intracellular inhibition and antidamage repair were discussed in the paper.

PMID: 7842869, UI: 95145151

Biol Pharm Bull 1994 Apr;**17(4):**539-542

Monoclonal antibody to proteoglycan derived from Grifola frondosa

(Maitake).

Hirata A, Adachi Y, Itoh W, Komoda M, Tabata K, Sugawara I

A murine monoclonal antibody (MAb) was prepared by immunizing BALB/c mice with a proteoglycan fraction derived from Grifola frondosa (Maitake mushroom), followed by the hybridization of spleen cells with mouse myeloma cells. The MAb (subclass; Ig G2b), designated MPG2, reacted with schizophyllan (SPG), curdlan, scleroglucan, laminarin and lentinan, but not with dextran, pullulan, mannan and xylan. Immunohistochemistry (ABC-GO method) showed that MAb MPG2 reacted with lysosomal proteoglycan and (1-->6)-beta-branched laminaritriose taken up by rabbit peritoneal macrophages. These results suggest that this MAb may recognize mainly (1-->3)-beta-D-glucan, and may be useful for determining the immunological properties of Grifola frondosa-derived proteoglycan.

PMID: 8069265, UI: 94348467

J Nutr Sci Vitaminol (Tokyo) 1994 Apr;**40(2):**81-94

Distribution of ascorbic acid analogs and associated glycosides in mushrooms.

Okamura M

Mushrooms contain reducing substances with chemical properties similar to ascorbic acid (AsA). In this study, the four types of reducing substances contained in Flammulina velutipes (Enokitake), Hypsizigus mamoreus (Bunashimeji), Pholiota nameko (Nameko), and Grifola frondosa (Maitake) were respectively purified, and the structure of each was analyzed using nuclear magnetic resonance (NMR) and other methods. The results confirmed that those substances were AsA analogs and associated glycosides (6-deoxy-AsA, 6-deoxy-5-O-(alpha-D-xylopyranosyl)-AsA, 6-deoxy-5-O-(alpha-D-glucopyranosyl)-AsA, and 5-O-alpha-D-glucopyranosyl-erythro-AsA). These substances were characteristic in that saccharide was bonded with the C-5 of the AsA analogs. Osazones were formed from the reducing substances in 19 kinds of edible mushrooms. Using thin-layer chromatography (TLC), they were developed to examine the distribution of the above reducing substances and AsA. The results showed that at least one of the above compounds was certain to be present in any mushroom; that AsA was present in very small quantities if at all; and that several substances similar to the above compounds were present.

PMID: 7931730, UI: 95017161

Biochim Biophys Acta 1990 Jun 20;**1034(3):**247-252

Isolation and characterization of a lectin from Grifola frondosa fruiting bodies.

Kawagishi H, Nomura A, Mizuno T, Kimura A, Chiba S

An N-acetylgalactosamine-specific lectin (GFL) was isolated from Grifola frondosa fruiting bodies by affinity chromatographies on acid-treated Sepharose CL-4B and then GalNAc-Toyopearl. The isolated lectin agglutinated all types of erythrocytes equally. Molecular masses estimated by gel filtration under various buffers and matrices varied from 30 to 52 kDa. On the other hand, SDS-PAGE in the presence or absence of 2-mercaptoethanol showed three major bands of 33, 66 and 100 kDa and a faint band of 65 kDa. This lectin exhibited GalNAc-specificity. The

protein was a glycoprotein containing 3.3% total sugar, and the amino acid analysis revealed a high content of acidic and hydroxy amino acids and a low content of methionine and histidine. GFL was cytotoxic against HeLa cells. The toxicity did not appear after preincubating the lectin with the haptenic sugar N-acetylgalactosamine.

PMID: 2364082, UI: 90304164

Chem Pharm Bull (Tokyo) 1990 Feb;**38(2):**477-481

Change of biological activities of (1----3)-beta-D-glucan from Grifola frondosa upon molecular weight reduction by heat treatment.

Adachi Y, Ohno N, Ohsawa M, Oikawa S, Yadomae T

Changes of biological activities manifested by (1----6)-branched (1----3)-beta-D-glucans of various molecular weights obtained by heat treatment of the corresponding intact beta-glucan at 150 degrees C (HD-LE) were examined. The activities assessed in this study were as follows: an antitumor activity, activation of alternative complement pathway, glucose consumption by macrophages, macrophage-mediated lysosomal enzyme activity in culture supernatant and cell lysate, interleukin-1 (IL-1) activity, and adjuvant activity. HD-LE could be classified into three groups: 1) HD-LE 0 h (MW 800000) which activated all of the biological activities tested, 2) HD-LE 0.5 and 3 h (MW 250000 and 21000) which lacked or exhibited low levels of activities such as activation of alternative complement pathway and lysosomal enzyme secretion, 3) HD-LE 6 h (MW 6400) which only activated glucose consumption and synthesis of lysosomal enzyme. These results suggest that an antitumor glucan is not always a multiple enhancer of host defense mechanisms and that a large molecular weight is required to augment multiple immunological activities.

PMID: 2337961, UI: 90249107

Chem Pharm Bull (Tokyo) 1989 Jul;**37(7):**1838-1843

Physiochemical properties and antitumor activities of chemically modified derivatives of antitumor glucan "grifolan LE" from Grifola frondosa.

Adachi Y, Ohno N, Ohsawa M, Sato K, Oikawa S, Yadomae T

Antitumor glucan, grifolan LE (GRN LE), from Grifola frondosa was chemically modified to examine the structure-function relationship of the products. Modification by periodate, borohydride and acid hydrolysis of side chains of GRN LE did not alter properties such as helical conformation and antitumor activity of GRN LE. Introduction of carboxylic acid groups into the side chains by oxidation with periodate and with sodium chlorite (GRN LE-PC), and substitution with carboxymethyl (CM) or hydroxyethyl (HE) groups abolished the gel-forming ability of GRN LE. Significant antitumor activity was observed in all of the derivtives having gel-forming ability as well as some derivatives having no such ability. These results suggested that essential factors required for antitumor activity were (1----3)-beta-D-glucosyl linkages and high molecular weight, and that accessory groups could be linked to the main chain without loss of antitumor activity in a higher ratio than that of gel-forming ability.

PMID: 2805163, UI: 90030576

Chem Pharm Bull (Tokyo) 1989 Feb;**37(2):**410-413

Antitumor and immunomodulating activities of a beta-glucan obtained from liquid-cultured Grifola frondosa.

Suzuki I, Hashimoto K, Oikawa S, Sato K, Osawa M, Yadomae T

The effects of the beta-1,3-glucan, LELFD, obtained from liquid-cultured mycelium of Grifola frondosa, on the growth of syngeneic tumors and immune responses in mice were examined. In Meth A or IMC solid tumor systems, LELFD administered intraperitoneally (i.p.) or intralesionally (i.l.) exhibited significant antitumor effects. However, the growth of L1210 and P388 leukemias was unaffected by the injection of LELFD. The injection of LELFD i.p. enhanced the activities of natural killer cells and macrophages in mice. LELFD also enhanced the antibody response when it was injected i.p. with sheep red blood cells into mice. Furthermore, it was found that LELFD could activate the alternative complement pathway.

PMID: 2743484, UI: 89304216

Chem Pharm Bull (Tokyo) 1988 May;**36(5):**1819-1827

Antitumor activity exhibited by orally administered extract from fruit body of Grifola frondosa (maitake).

Hishida I, Nanba H, Kuroda H

PMID: 3203420, UI: 89077611

Chem Pharm Bull (Tokyo) 1988 Mar;**36(3):**1000-1006

Blood pressure-lowering activity present in the fruit body of Grifola frondosa (maitake). I.

Adachi K, Nanba H, Otsuka M, Kuroda H

PMID: 3409391, UI: 88311245

J Pharmacobiodyn 1987 Nov;**10(11):**644-651

Host-mediated antitumor effect of grifolan NMF-5N, a polysaccharide obtained from Grifola frondosa.

Takeyama T, Suzuki I, Ohno N, Oikawa S, Sato K, Ohsawa M, Yadomae T

The antitumor mechanism of grifolan NMF-5N, a beta-1,3-glucan obtained from mycelia of Grifola frondosa, was examined. Grifolan NMF-5N did not show direct cytocidal effect on cultured tumor cells. However, intraperitoneal injection of grifolan NMF-5N increased the number of peritoneal exudate cells and peritoneal adherent cells which showed cytostatic activity towards syngeneic tumor cells. In an in vivo assay, the administration of carrageenan, an inhibitor of macrophage function, reduced the antitumor activity of grifolan NMF-5N. The delayed-type hypersensitivity reaction was augmented in the grifolan NMF-5N-administered mice. The administration of

NMF-5N augmented the induction of cytotoxic T cells but the antitumor activity of grifolan NMF-5N was reduced in athymic nu/nu mice. In addition, the treatment with anti-Thy 1,2 antibody and complement C' of spleen cells taken from mice which showed regression of tumor due to grifolan NMF-5N, reduced the neutralizing effect in Winn assay. These results suggested that grifolan NMF-5N shows antitumor activity via host-mediated mechanisms and both macrophages and T cells play important roles in the mechanisms.

PMID: 3446772, UI: 88188016

J Nutr Sci Vitaminol (Tokyo) 1987 Oct;**33(5):**341-346

Effect of shiitake (Lentinus edodes) and maitake (Grifola frondosa) mushrooms on blood pressure and plasma lipids of spontaneously hypertensive rats.

Kabir Y, Yamaguchi M, Kimura S

To study the effect of Shiitake (Lentinus edodes) and Maitake (Grifola frondosa) on hypertension, spontaneously hypertensive rats (SHR) were fed a diet containing 5% mushroom powder and 0.5% NaCl solution as drinking water for 9 weeks. The dietary mushrooms decreased the blood pressure. The plasma free cholesterol level decreased in Shiitake-fed animals, whereas in Maitake-fed animals the total cholesterol level decreased. There was no difference in the plasma triglyceride and phospholipid levels among the experimental groups. Shiitake feeding resulted in a decrease in VLDL- and HDL-cholesterol whereas Maitake feeding caused a decrease in VLDL-cholesterol only. Plasma LDL-cholesterol was not affected by dietary mushrooms. The results suggest that dietary mushrooms prevent blood pressure increase in hypertension.

PMID: 3443885, UI: 88171777

Chem Pharm Bull (Tokyo) 1987 Jun;**35(6):**2585-2588

Conformation of grifolan in the fruit body of Grifola frondosa assessed by carbon-13 cross polarization-magic angle spinning nuclear magnetic resonance spectroscopy.

Ohno N, Ohsawa M, Sato K, Oikawa S, Yadomae T

PMID: 3664855, UI: 88027344

Chem Pharm Bull (Tokyo) 1987 Mar;**35(3):**1162-1168

The chemical structure of an antitumor polysaccharide in fruit bodies of Grifola frondosa (maitake).

Nanba H, Hamaguchi A, Kuroda H

PMID: 3607939, UI: 87273641

J Pharmacobiodyn 1987 Feb;**10(2):**72-77

Antitumor effect of polysaccharide grifolan NMF-5N on syngeneic tumor in mice.

Suzuki I, Takeyama T, Ohno N, Oikawa S, Sato K, Suzuki Y, Yadomae T

Antitumor activity of grifolan NMF-5N, a beta-1,3-glucan obtained from mycelia of Grifola frondosa, was examined. Grifolan NMF-5N showed antitumor activities in allogeneic and syngeneic murine tumor systems. In the allogeneic tumor system, a potent antitumor activity over 95% was observed against the solid form of sarcoma 180 when grifolan NMF-5N was injected intraperitoneally (i.p.) at 25-200 micrograms/mouse daily for 10 successive days. In the syngeneic tumor systems, significant antitumor activities were observed against Meth A fibrosarcoma and MM 46 carcinoma by injection at 100 micrograms/mouse daily for 5 successive days, especially i.p. injection at day 7-11, when the tumor cells were inoculated subcutaneously (s.c.) on day 0. Moreover, when grifolan NMF-5N was injected i.p. every other week, significant antitumor activity was also observed. In addition, a single treatment with grifolan NMF-5N at 500 micrograms/mouse showed antitumor activities. Grifolan NMF-5N exhibited antitumor activities against these two syngeneic tumors by intraveneous (i.v.) injection. However, a marked inhibitory activity was observed by intratumorous (i.t.) injection against Meth A fibrosarcoma but not against MM46 carcinoma. These results suggest that antitumor activities of grifolan NMF-5N in murine syngeneic tumor systems depend on not only dosage but also injection routes and timing.

PMID: 3598845, UI: 87253772

Chem Pharm Bull (Tokyo) 1987 Jan;**35(1):**262-270

Potentiation of host-mediated antitumor activity in mice by beta-glucan obtained from Grifola frondosa (maitake).

Adachi K, Nanba H, Kuroda H

PMID: 3594655, UI: 87244512

J Pharmacobiodyn 1986 Oct;**9(10):**861-864

Antitumor activity of a beta-1,3-glucan obtained from liquid cultured mycelium of Grifola frondosa.

Ohno N, Adachi Y, Suzuki I, Oikawa S, Sato K, Ohsawa M, Yadomae T

The antitumor activity of a branched beta-1,3-glucan "grifolan LE" purified from liquid cultures of Grifola frondosa (Ohno et al. Chem. Pharm. Bull., 34, 1709-1715 (1986] was examined on an allogeneic murine tumor system. By intraperitoneal (i.p.) administration (100-200 micrograms/mouse/d X 5) at days 1 to 9 from the tumor transplantation, grifolan LE showed marked inhibitory activity on the growth of solid form sarcoma 180 in ICR mice. Significant activity was also observed in intravenous (i.v.) or intratumoral (i.t.) administrations. However, the oral (p.o.) administration of grifolan LE was not effective. I.p. administration of grifolan LE at a dose of 100 micrograms/mouse/d X 5 before the tumor transplantation showed significant inhibition of tumor growth. I.p. administration of grifolan LE at day +11 to +19 was also effective. Grifolan LE was not effective on the ascites form of sarcoma 180. The pretreatment of sarcoma 180 cell with grifolan LE in vitro did not affect tumor growth. The mice cured from the solid form of sarcoma 180 by administration of grifolan LE had the ability to reject the same tumor cell. From these results, it is suggested that the antitumor activity of grifolan LE occurred by modification of biological responses.

PMID: 3820062, UI: 87140756

Chem Pharm Bull (Tokyo) 1986 Aug;**34(8):**3328-3332

Fractionation of acidic antitumor beta-glucan of Grifola frondosa by anion-exchange chromatography using urea solutions of low and high ionic strengths.

Ohno N, Iino K, Oikawa S, Sato K, Ohsawa M, Yadomae T

PMID: 3791504, UI: 87078554

Chem Pharm Bull (Tokyo) 1986 Jun;**34(6):**2555-2560

Two different conformations of antitumor glucans obtained from Grifola frondosa.

Ohno N, Adachi Y, Suzuki I, Oikawa S, Sato K, Suzuki Y, Ohsawa M, Yadomae T

PMID: 3769071, UI: 87028397

Chem Pharm Bull (Tokyo) 1986 Apr;**34(4):**1709-1715

Characterization of the antitumor glucan obtained from liquid-cultured Grifola frondosa.

Ohno N, Adachi Y, Suzuki I, Sato K, Oikawa S, Yadomae T

PMID: 3719872, UI: 86245364

Chem Pharm Bull (Tokyo) 1985 Nov;**33(11):**4950-4956

Structure-function Relationship of antitumor beta-1,3-glucan obtained from matted mycelium of cultured Grifola frondosa.

Iino K, Ohno N, Suzuki I, Sato K, Oikawa S, Yadomae T

PMID: 3830423, UI: 86161964

Chem Pharm Bull (Tokyo) 1985 Aug;**33(8):**3395-3401

Structural characterization and antitumor activity of the extracts from matted mycelium of cultured Grifola frondosa.

Ohno N, Iino K, Takeyama T, Suzuki I, Sato K, Oikawa S, Miyazaki T, Yadomae T

PMID: 4085071, UI: 86106378

Chem Pharm Bull (Tokyo) 1985 Apr;**33(4):**1557-1562

Carbon-13 nuclear magnetic resonance spectral analysis of the fruit bodies of Grifola frondosa.

Ohno N, Iino K, Suzuki I, Sato K, Oikawa S, Yadomae T

PMID: 4042232, UI: 86002480

Chem Pharm Bull (Tokyo) 1985 Mar;**33(3):**1181-1186

Neutral and acidic antitumor polysaccharides extracted from cultured fruit bodies of Grifola frondosa.

Ohno N, Iino K, Suzuki I, Oikawa S, Sato K, Miyazaki T, Yadomae T

PMID: 4040819, UI: 85282885

J Pharmacobiodyn 1985 Mar;**8(3):**217-226

Effect of a polysaccharide fraction from Grifola frondosa on immune response in mice.

Suzuki I, Itani T, Ohno N, Oikawa S, Sato K, Miyazaki T, Yadomae T

The biological and immunomodulating activities of polysaccharide fraction (GF-1), an antitumor poysaccharide fraction from cultured fruiting bodies of Grifola frondosa, was examined in mice. GF-1 showed no cytocidal effect on culturing tumor cells. However, GF-1 induced resistance against Sarcoma 180 in ICR mice which had completely regressed from the tumor by the effect of GF-1. The administration of GF-1 into mice increased the weights or cell numbers of spleen, and peritoneal cavity. GF-1 enhanced the antigen specific antibody response and carbon clearance activity, whereas GF-1 did not show polyclonal B cell activation and mitogenic activities, and the effect on delayed type hypersensitivity.

PMID: 3891963, UI: 85236910

J Pharmacobiodyn 1984 Jul;**7(7):**492-500

Antitumor activity of a polysaccharide fraction extracted from cultured fruiting bodies of Grifola frondosa.

Suzuki I, Itani T, Ohno N, Oikawa S, Sato K, Miyazaki T, Yadomae T

Antitumor activity of a polysaccharide fraction (GF-1) extracted from cultured fruiting bodies of a fungus, Grifola frondosa, was examined on allogeneic and syngeneic tumors in mice. GF-1 had a marked inhibitory activity against the growth of subcutaneously (s.c.) inoculated Sarcoma 180 by the intraperitoneally (i.p.) injection at 0.5-5.0 mg/mouse for 10 successive days. A significant antitumor activity was also observed when GF-1 at 4.0 mg/mouse was i.p. injected successively on days +1-+5, +7-+11, +14-+18 or +21-+25 if the tumor cells were inoculated s.c. on day 0. Similar results were obtained by a single i.p. injection of GF-1 at 2.0 mg/mouse on day +1, +7, +14 or +21. When GF-1 was injected i.p., intravenously (i.v.) or intratumorally (i.t.), all of them showed an equivalent level of higher inhibitory activity (inhibition ratio; over 90%). However, the oral (p.o.) administration was not effective. The pretreatment of mice with GF-1 at 2.0 or 4.0 mg/mouse for 5 times before tumor inoculation did not show a significant antitumor activity. In addition, GF-1 administered i.p. at varying times before and/or after the tumor inoculation showed no antitumor activity against ascites form of Sarcoma 180. In the syngeneic systems, GF-1 exhibited an antitumor activity against solid form of Meth A fibrosarcoma in BALB/c mice and MM46 carcinoma in C3H/He mice.

PMID: 6491867, UI: 85033136

Chem Pharm Bull (Tokyo) 1984 Mar;**32(3):**1142-1151

Antitumor activity and structural characterization of glucans extracted from cultured fruit bodies of Grifola frondosa.

Ohno N, Suzuki I, Oikawa S, Sato K, Miyazaki T, Yadomae T

PMID: 6744487, UI: 84259545

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4 citations found

Chung Kuo Chung Hsi I Chieh Ho Tsa Chih 1994 Jul;**14(7):**427-428

[Immunomodulatory function of polysaccharide of Hericium erinaceus].

[Article in Chinese]

Xu HM, Xie ZH, Zhang WY

Hericium erinaceus is a Chinese herbal medicine. The Apollo oral liquid contains polysaccharide of H. erinaceus (PHE). The effects of PHE on proliferation of mice T and B lymphocytes were studied. Results showed that (1) 3-fold proliferation of thymocytes was demonstrated when PHE were administrated with Con A than Con A alone. Such effect on thymocyte was not observed when PHE was used alone. (2) Proliferation of spleen lymphocytes was also stimulated when PHE were taken together with lipopolysaccharide, which was 50% and 3 times stronger than that of using lipopolysaccharide and PHE alone respectively.

PMID: 7950232, UI: 95037554

Yao Hsueh Hsueh Pao 1990;**25(7):**522-525

[Isolation and identification of two new pyrone compounds from the culture of Herictum erinaceus].

[Article in Chinese]

Qian FG, Xu GY, Du SJ, Li MH

Four crystalline and one liquid compounds were isolated from the solid cultured extract of Hericium erinaceus, Two of them are new, named herein III and IV. Their chemical structures were determined as 6-methyl-2,5-dihydroxymethyl-gamma-pyranone (III) and 2-hydroxymethyl-5-alpha-hydroxy-ethyl-gamma-pyranone (IV). The others are 4-chloro-3,5-dimethoxybenzoic-O-arabitol ester, 4-chloro-3,5-dimethoxybenzoic methyl ester and 4-chloro-3,5-dimethoxybenzoic acid. In addition, a mixture of palmic and stearic acid, a mixture of behenic acid and tetracosanic acid and a mixture of 5 alpha-ergostan-3-one, 5 alpha-stigmasten-22-en-3-one and 5 alpha-stigmastan-3-one were also isolated.

PMID: 2085129, UI: 91196588

Chung Hua Chung Liu Tsa Chih 1987 Mar;**9(2):**109-111

[Effect of six edible plants on the development of AFB1-induced gamma-

glutamyltranspeptidase-positive hepatocyte foci in rats].

[Article in Chinese]

Chen ZY, Yan RQ, Qin GZ, Qin LL

Six edible plants, green tea (GT), black tea (BT), Lentinus edodes (berk) Sing (LE), Hericium erinaceus (Bull. ex Fr.) Pers. (HE), Mixture of Ganoderma Lucidum (Ley ss ex Fr.) Karst et Ganoderma Japanium (Fr.) Lloyd (MGLJ) and mung bean (MB), were tested for the effect on the development of AFB1-induced gamma-glutamyltranspeptidase positive hepatocyte foci (gamma-GT foci) using an in vivo short-term test model in rats. The rats received intraperitoneally 12 doses of initiator AFB1, 400 micrograms/kg per dose for 2 successive weeks. Two weeks after the initiation, the rats were submitted to a modified "Solt-Farber promotion program", i.e., a two weeks' feeding of a diet containing 0.015% acetylaminofluorene plus a two-third partial hepatectomy (PH) on day 7. The rats were sacrificed 10 days after PH and the livers were processed to gamma-glutamyltranspeptidase staining. The tested substances were powdered and mixed with the basal diet at the concentration level of 30% for MB and 5% for the others. The rats were fed with the diet-containing tested substances from 10 days before the AFB1 initiation to 3 days after the AFB1 conclusion. Consequently, the liver of the rats which had consumed GT showed significantly less and smaller gamma-GT foci, and those which had consumed BT, HE and LE showed somewhat less and significantly smaller foci than the control groups. It is indicated that the four diets have an inhibiting effect on AFB1-induced gamma-GT foci in different degrees. MB and MGLJ show no significant influence on the foci.

PMID: 2443327, UI: 88003983

Chin Med J (Engl) 1985 Jun;**98(6):**455-456

A double-blind study of effectiveness of hericium erinaceus pers therapy on chronic atrophic gastritis. A preliminary report.

Xu CP, Liu WW, Liu FX, Chen SS, Liao FQ, Xu Z, Jiang LG, Wang CA, Lu XH

Publication Types:

- Clinical trial

PMID: 3932005, UI: 86029526

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96 citations found

FEMS Microbiol Lett 1997 Sep 15;**154(2):**195-200

Aggregation of yeast cells induced by the Arg-Gly-Asp motif-containing fragment of high-molecular-mass cell-adhesion protein MFBA, derived from the basidiomycetous mushroom Lentinus edodes.

Yasuda T, Shishido K

A fruiting body-specific cDNA mfbAc, derived from the basidiomycete Lentinus edodes, has been shown to encode a high-molecular-mass (2157 amino acids) cell-adhesion protein MFBA containing the Arg-Gly-Asp (RGD) motif. A 425-amino-acid fragment containing the RGD motif of MFBA (designated MFBA(582-1006) peptide) produced in Escherichia coli exhibited cell-adhesion and spreading activity toward mammalian cells and cell-aggregation activity toward basidiomycetous hyphal cells via the RGD sequence. Here we investigated the biological activity of MFBA(582-1006) peptide in Saccharomyces cerevisiae. The DNA sequence encoding MFBA(582-1006) peptide, introduced into the yeast using an expression vector, resulted in a marked aggregation of the yeast cells. The aggregation was almost completely abolished by replacement of the RGD motif by an RGE motif in the peptide sequence.

PMID: 9311116, UI: 97457178

Biosci Biotechnol Biochem 1997 Sep;**61(9):**1587-1589

Generation of basidiomycetous hyphal cell-aggregates by addition of the Arg-Gly-Asp motif-containing fragment of high-molecular-weight cell-adhesion protein MFBA derived from the basidiomycete Lentinus edodes.

Yasuda T, Ishihara H, Amano H, Shishido K

[Medline record in process]

The Arg-Gly-Asp (RGD) motif-containing fragment of high-molecular-weight cell-adhesion protein MFBA derived from Lentinus edodes caused a significant aggregation of the fragmented hyphal cells of Schizophyllum commune. This fungal cell-aggregation was inhibited by a previous treatment of the cells with the Gly-Arg-Gly-Asp-Ser-Pro peptide, but not with the Gly-Arg-Gly-Glu-Ser-Pro peptide, showing that the RGD motif is essential for the cell-aggregation activity.

PMID: 9339565, UI: 97480949

Microbiologia 1997 Jun;**13(2):**185-192

Production of carpophores of Lentinus edodes and Ganoderma lucidum grown on cork residues.

Riu H, Roig G, Sancho J

Cork, being widely used in industry, generates high amounts of waste of difficult elimination because of its complex biological degradation, and the high pollutant smokes from its burning. Similarities between suberin (major component of cork) and lignin suggest that fungi with high lignin degrading capacity could colonize cork residues. Basidiomycetes such as Lentinus edodes and Ganoderma lucidum, besides their capacity for degrading, are edible. Thus, while using them to degrade cork, it is also possible to obtain a food product. In this study, dry matter was reduced 40%, suberin was degraded 45%, oxidizable carbon was increased 35%, and Lentinus showed a high rate of growth. These results indicate that there is an environmental alternative to the elimination of residues from the cork industry.

PMID: 9253758, UI: 97397901

Immunopharmacol Immunotoxicol 1997 May;**19(2):**175-183

Effects of Lentinus edodes, Grifola frondosa and Pleurotus ostreatus administration on cancer outbreak, and activities of macrophages and lymphocytes in mice treated with a carcinogen, N-butyl-N-butanolnitrosoamine.

Kurashige S, Akuzawa Y, Endo F

ICR mice were treated with a carcinogen, N-butyl-N'-butanolnitrosoamine BBN), every day for 8 consecutive weeks and the effects of oral administration of edible mushrooms on the induction of urinary bladder carcinoma and on the activities of macrophages and lymphocytes were studied. Bladder carcinoma were found in all 10 mice (100%) treated with BBN alone, while we observed carcinoma only in 9 of 17 mice (52.9%), in 7 of 15 mice (46.7%) and 13 of 20 mice (65.0%) treated with Lentinus edodes, Grifola frondosa and Pleurotus ostreatus, respectively. Chemotactic activity of macrophages was suppressed in mice treated with BBN alone but maintained almost the normal level in mice treated with BBN plus Lentinus, Grifola or Pleurotus. Lymphocytes collected from mice treated with BBN plus each mushroom showed almost normal blastogenic response against concanavalin A, although those from mice treated with BBN alone completely retarded their response. Cytotoxic activity of lymphocytes against Yac-1 cells was also maintained at a normal level in mice treated with BBN plus each mushroom. Whereas in mice treated with BBN alone significant depression of NK cell activity occurred. Significantly higher cytotoxic activity against P-815 cells was observed in lymphocytes from mice treated with BBN plus each mushroom than that in lymphocytes from normal mice or mice treated with BBN alone.

PMID: 9130004, UI: 97276251

Physiol Behav 1997 Mar;**61(3):**399-410

Effects of lentinan on abnormal ingestive behaviors induced by tumor necrosis factor.

Tamura R, Tanebe K, Kawanishi C, Torii K, Ono T

Lentinan (LNT), a beta-glucan derived from Lentinus edodes (Berk.) Sign., is known to work positively against cachexia in patients with malignant tumors. Because the cachectin/tumor necrosis factor (TNF) is supposed to be one of the factors that mediate cancer cachexia, we tested the effects of LNT on TNF-induced cachexia in rats. First, we analyzed in detail the cachectic actions of TNF (0.2 mg/kg/day, 5 days, IV) on food and water intake, body weight, and locomotor activity. The day after the first administration of TNF (acute phase), food and water intake, as well as body weight, of all rats decreased. However, over the next few days of treatment (chronic phase), the rats gradually developed a tolerance to the cachectic actions of TNF. Specifically, after the third administration, the rats treated with TNF had a higher amount of water intake than the control rats. This was mainly due to an increase in daytime water intake. We also analyzed the effects of LNT (0.1 or 1.0 mg/kg, twice/wk. IV) on TNF-induced cachexia, and compared the data with those from the rats treated with TNF alone. The higher dosage of LNT significantly suppressed TNF-induced daytime polydipsia and increased the amount of nighttime water intake, as well as the meal size of nighttime food intake. These results suggest that LNT partially normalizes TNF-induced cachexia in rats.

PMID: 9089759, UI: 97245000

J Intern Med 1997 Jan;**241(1):**85-88

Decreased pulmonary perfusion in hypersensitivity pneumonitis caused by Shiitake mushroom spores.

Murakami M, Kawabe K, Hosoi Y, Hojo S, Dobashi K, Iriuchijima T, Nakazawa T, Mori M

Hypersensitivity pneumonitis is an occupational hazard of mushroom workers. We describe a patient with severe hypersensitivity pneumonitis caused by spores of the Shiitake mushroom (Lentinus edodes) who showed a marked decrease in pulmonary perfusion, as demonstrated by pulmonary scintigraphy. This patient was treated successfully with prednisolone. These results suggest that pulmonary vasculitis may be associated with patients with hypersensitivity pneumonitis, and that steroid therapy may be clinically useful in treatment.

PMID: 9042098, UI: 97194660

Biosci Biotechnol Biochem 1996 Aug;**60(8):**1273-1278

Purification and properties of tyrosinase isozymes from the gill of Lentinus edodes fruiting body.

Kanda K, Sato T, Ishii S, Enei H, Ejiri S

Six tyrosinase isozymes were purified from the browned gill of the fruiting body of Lentinus edodes by ammonium sulfate fractionation, DEAE-Sephacel and Q-Sepharose column chromatography, and partially denaturing SDS-PAGE. At the step of Q-Sepharose column chromatography, two active fractions (A and B) were obtained. Each fraction was separated to three further fractions, A1, A2, and A3, and B1, B2, and B3, respectively, by partially denaturing SDS-PAGE. All these isozymes consisted of two types of polypeptides: alpha polypeptide (A alpha or B alpha) and either beta (A beta or B beta) or gamma polypeptide (A gamma or B gamma). The alpha polypeptide contained the consensus amino acid sequence of the active site of known tyrosinases, which is considered to act as a catalytic subunit. From the results of peptide mapping and the amino acid composition, A alpha and B alpha polypeptides were considered to be different proteins. The kinetic properties of the purified tyrosinase isozymes differed greatly according to whether they contained beta or gamma polypeptide, indicating

these polypeptides to be a possible regulatory subunit.

PMID: 8987542, UI: 97141198

Biol Pharm Bull 1996 Aug;**19(8):**1080-1082

Enzymatic activities of several K108 mutants of ribonuclease (RNase) Rh isolated from Rhizopus niveus.

Ohgi K, Iwama M, Ogawa Y, Hagiwara C, Ono E, Kawaguchi R, Kanazawa C, Irie M

We previously investigated the role of the Lys108 residue of ribonuclease (RNase) Rh from Rhizopus niveus, and suggested that Lys108 probably acts to stabilize the pentacovalent intermediate, and that an Arg residue could replace the role of Lys108. In RNase Le2 from Lentinus edodes, a homologous enzyme of RNase Rh, Lys108 is replaced by Thr. In this paper, the enzymatic properties of a K108T mutant and its analogous enzyme, K108S, were investigated to determine the effect of Thr and its analog, Ser at the 108th position on enzyme activity. The enzymatic properties of these mutant enzymes were compared with those of other mutant enzymes at this position (K108M, K108A, K108L). The results showed that Thr and Ser could replace Lys108 but resulted in only 2-20% of the activity of the native enzyme depending on the substrates used.

PMID: 8874821, UI: 97028808

Biochem Mol Biol Int 1996 Jul;**39(4):**679-685

Preparation and specificity of antibodies to an anti-tumor beta-glucan, lentinan.

Mizono M, Minato K, Tsuchida H

Antibodies against beta-glucan, lentinan from "Shiitake" (Lentinus edodes), were raised in the rabbit by subcutaneous immunization. Our antibodies did not recognize the other polysaccharides such as amylose, dextran, laminarin and galactan. It was proved that lentinan contents in mushroom could be measured by ELISA with the anti-lentinan antisera. Its contents were 3.5 mg/g fresh weight in Lentinus edodes. However, lentinan was not contained in Agaricus brazei, Agaricus bisporus and Ramaria bitrytis.

PMID: 8843335, UI: 97000193

J Nutr Sci Vitaminol (Tokyo) 1996 Apr;**42(2):**97-110

Effects of semi-purified dietary fibers isolated from Lagenaria siceraria, Raphanus sativus and Lentinus edodes on fecal steroid excretions in rats.

Sannoumaru Y, Shimizu J, Nakamura K, Hayakawa T, Takita T, Innami S

Rats were fed diets, each of which contained 5% of the semi-purified dietary fiber (DF) preparations from three kinds of foods, continuously for a total of 7 weeks. The fat level was varied, and cholesterol (Chol) was added toward the end of the experimental period. After 7 weeks, decreases of serum and liver Chol concentrations were observed in the Shiitake (Lentinus edodes) group when compared to the cellulose (CP) group. In the absence of

Chol, fecal excretions of several secondary bile acids and total bile acids were affected by the type of DF, showing an increase particularly in the Shiitake group. Total neutral steroid excretions were decreased in the test DF groups compared to the CP group at both fat levels, and were increased by Chol supplementation in all of the test DF groups. It was demonstrated that the effects of the three DF preparations on fecal steroid excretions somewhat differed depending on the dietary factors. In the absence of Chol, the lithocholic acid (LCA)/deoxycholic acid (DCA) ratio was significantly lowered in the test DF groups compared to the CP group by the fat level elevation, and was affected by the interaction of fiber with fat. This ratio responded more intensely to the dietary factors than the two other indices (composition ratios of fecal bile acids). However, this response was lost in the presence of Chol. These results suggest that further studies are warranted to examine if the intense response of the LCA/DCA ratio to the tested DF preparations and fat in the present study will also be shown to other DF and what significance it has in evaluating the function of DF.

PMID: 8780968, UI: 96374741

Lipids 1996 Apr;**31(4):**399-404

Dietary eritadenine-induced alteration of molecular species composition of phospholipids in rats.

Sugiyama K, Yamakawa A

The effect of dietary eritadenine, a hypocholesterolemic compound found in the mushroom Lentinus edodes, on the fatty acid and molecular species profiles of phosphatidylcholine (PC) and phosphatidylethanolamine (PE) in the plasma and liver microsomes was investigated in relation to the hypocholesterolemic action of the compound in rats. Animals were fed the control or eritadenine-supplemented (50 mg/kg diet) diet for 14 d. Eritadenine supplementation significantly decreased the plasma concentrations of cholesterol and phospholipids, but not triglycerides. The PC/PE ratio of liver microsomes, but not plasma, was also markedly decreased by eritadenine. Eritadenine supplementation was found to increase the proportion of 18:2n-6 and, inversely, to decrease the proportion of 20:4n-6 and 22:5n-6 in plasma PC and liver microsomal PC and PE, indicating that eritadenine depressed the metabolism of linoleic acid. The effect of eritadenine on the profile of n-3 fatty acids was dissimilar in PC and PE. These changes in fatty acid composition were selectively reflected in the molecular species composition of both PC and PE; the extent of increase in 16:0-18:2 molecular species or decrease in 18:0-20:4 molecular species was apparently greater than that of other molecular species containing 18:2 or 20:4 in the sn-2 position. These results suggest that, in addition to the decrease in liver microsomal PC/PE ratio, the alteration of plasma PC molecular species composition might also participate in the hypocholesterolemic action of eritadenine.

PMID: 8743052, UI: 96294990

Biosci Biotechnol Biochem 1996 Mar;**60(3):**472-475

The integrative transformation of Pleurotus ostreatus using bialaphos resistance as a dominant selectable marker.

Yanai K, Yonekura K, Usami H, Hirayama M, Kajiwara S, Yamazaki T, Shishido K, Adachi T

A plasmid pLC-bar containing the bialaphos resistance gene derived from Streptomyces hygroscopicus between the Lentinus edodes ras gene promoter and priA gene terminator was constructed. When protoplasts of Pleurotus ostreatus were mixed with the plasmid DNA in the presence of polyethylene glycol and CaCl2, bialaphos-resistant colonies were obtained. This indicated that transformation was successful. Southern blot analysis of total DNAs from transformants showed that the introduced plasmid DNA was integrated into the host chromosome and partly

rearranged. A plasmid, pLC-GUS, containing the Escherichia coli beta-glucuronidase (GUS) gene under the control of the L. edodes ras gene promoter and priA gene terminator was constructed and introduced into protoplasts of P. ostreatus with pLC-bar by co-transformation. Two of 5 transformants obtained as bialaphos-resistant colonies showed two to twenty times higher specific activity of GUS than the recipient. Southern blot analysis of total DNAs from transformants indicated the presence of the GUS gene only in the two transformants. These results indicated that co-transformation of P. ostreatus was successful, and that the GUS gene was expressed in P. ostreatus. This transformation system will enable us to breed commercial strains of P. ostreatus at the molecular level.

PMID: 8901106, UI: 97056767

Yakugaku Zasshi 1996 Feb;**116(2):**169-173

[Influences of a shiitake (Lentinus edodes)-fructo-oligosaccharide mixture (SK-204) on experimental pulmonary thrombosis in rats].

[Article in Japanese]

Otsuka M, Shinozuka K, Hirata G, Kunitomo M

Effects of the mixture (SK-204) consisting of dried shiitake mushroom (Lentinus edodes) treated with wet-heating and fructo-oligosaccharides (7:3) on the experimental models of pulmonary thrombosis induced by lactic acidosis in rats were evaluated. Chronic oral administration (10 weeks) of SK-204 significantly prevented the thrombus formation on this thrombosis model. However, decreases in the numbers of platelet and fibrinogen level by lactate were not changed by SK-204. These results suggest that SK-204 have an anti-thrombotic action, which is due to neither the inhibition of platelet aggregation nor coagulation, but probably due to the promotion of fibrinolysis and thrombolysis.

PMID: 8717283, UI: 96307609

Yao Hsueh Hsueh Pao 1996;**31(2):**86-90

[The immunomodulatory effect of lentinan].

[Article in Chinese]

Wang GL, Lin ZB

Lentinan (LTN) was extracted from Lentinus edodes (Berk) Sing with molecular weight of 5 x 10(5). The effects of lentinan on cellular immune function were studied in vivo by measuring the cellular delayed type hypersensitivity (DTH) to dinitrofluorobenzene (DNFB) in cyclophosphamide (Cy)-comprised mice. The effect of lentinan on T lymphocyte proliferation to Con A on splenocytes and T lymphocyte subpopulations on thymocytes and on splenocytes from normal mice were also evaluated. Moreover, the effect of LTN on production of tumor necrosis factor (TNF) from murine peritoneal macrophage was also tested. LTN was administered at doses of 1, 5 and 10 mg.kg-1.d-1. The following results were observed: LTN administration(X6) augmented the T lymphocyts proliferation to Con A in normal mice; LTN restorated the DTH to DNFB impaired by single Cy(200 mg.kg-1 and 80 mg.kg-1, ip) after using LTN for 8 or 5 d; LTN administration (X6) either decreased the percentage of L3T4+ (Th), Lyt2+ (Ts) in thymocytes or increased the percentage of L3T4+, Lyt2+ in splenocytes; LTN(X6) administration elicited release of TNF from M phi in the presence of lipoplysaccharide (LPS). These results indicate that the immunomodulating effect of LTN may be relevant to change of T cell subpopulation and increase of TNF production.

PMID: 8762466, UI: 96286733

Biosci Biotechnol Biochem 1995 Nov;**59(11):**2097-2103

Base non-specific acid ribonuclease from Irpex lacteus, primary structure and phylogenetic relationships in RNase T2 family enzyme.

Watanabe H, Fauzi H, Iwama M, Onda T, Ohgi K, Irie M

Two base non-specific acid RNases (RNase Irp1 and RNase Irp2) were purified from a commercial enzyme, "Driselase" (Irpex lacteus) in a homogenous state on SDS-PAGE by several steps of chromatographic separations. RNAse Irp2 was a simple polypeptide with 235 amino acid residues and RNase Irp1 was a glycopeptide with 248 amino acid residues. The amino acid sequences of both RNases were identified by Edman degradation of the peptides derived from these RNAses. RNase Irp1 was composed of the RNase Irp2 and extra C-terminal 13 residues of peptide. The phylogenetic relation of these RNases with the other fungal RNases already known was discussed. The sequence of RNase Irp2 was very highly homologous (67.5%) with that of RNase Le2 from Lentinus edodes.

PMID: 8541649, UI: 96100940

FEMS Microbiol Lett 1995 Aug 1;**130(2-3):**189-192

Characterization of the promoter region of a cell-adhesion protein gene derived from the basidiomycete Lentinus edodes.

Kondoh O, Shishido K

An analysis of the 2 kb nucleotide sequence including the 5'-flanking region of a cell-adhesion protein-encoding gene (mfbA) isolated from the basidiomycete Lentinus edodes revealed that the promoter region contains a TATA box, a GC box, a CAAT box, a CT-rich sequence element, a TATA box, two CT-rich sequences, and a CAAT box, in the order, from upstream to downstream. Three major and three alternative transcriptional initiation sites were located 127, 129 and 131 nucleotides and 96, 193 and 197 nucleotides downstream from the downstream TATA box, and all the three major sites are positioned just in the most downstream CT-rich sequence. Three 16 bp unique sequences similar to the binding sites of Neurospora crassa transcriptional activator protein qa-1F (Baum et al. (1987) Expression of qa-1F activator protein: Identification of upstream binding sites in the qa gene cluster and localization of the DNA-binding domain. Mol. Cell. Biol. 7, 1256-1266) were present between the upstream TATA box and upstream CAAT box.

PMID: 7649440, UI: 95377603

J Nutr 1995 Aug;**125(8):**2134-2144

Hypocholesterolemic action of eritadenine is mediated by a modification of hepatic phospholipid metabolism in rats.

Sugiyama K, Akachi T, Yamakawa A

The hypocholesterolemic action of eritadenine, a compound found in the mushroom Lentinus edodes, was

investigated in relation to its influence on phospholipid metabolism in the liver of rats fed diets containing different amounts of choline chloride (0, 2 and 8 g/kg diet). The time-dependent effect of eritadenine supplementation was also investigated. Eritadenine supplementation (50 mg/kg diet) significantly decreased the phosphatidylcholine (PC):phosphatidylethanolamine (PE) ratio in liver microsomes and the S-adenosylmethionine (SAM):S-adenosylhomocysteine (SAH) ratio in the liver, in addition to the plasma cholesterol concentration, irrespective of dietary choline levels. There was a significant correlation between the plasma cholesterol concentration and the liver microsomal PC:PE ratio. Although eritadenine caused fatty liver when added to the diets containing 0 or 2 g/kg choline chloride, a high level (8 g/kg) of choline chloride fully prevented the eritadenine-induced fatty liver without diminution of hypocholesterolemic action. Both the PC:PE ratio and the SAM:SAH ratio decreased significantly prior to the decrease in the plasma cholesterol concentration (1 d vs. 2 d after) in response to eritadenine supplementation, supporting the hypothesis that the alteration of hepatic phospholipid metabolism may be a cause of the hypocholesterolemic action of eritadenine. These observations suggest that the essential hypocholesterolemic action of eritadenine might be associated with a modification of hepatic phospholipid metabolism rather than with the PC deficiency, due to the inhibition of PE N-methylation.

PMID: 7643248, UI: 95370971

Z Lebensm Unters Forsch 1995 Jul;**201(1):**17-19

[Mineral and amino acid contents of edible, cultivated shii-take mushrooms].

[Article in German]

Vetter J

World wide about 200,000 tons of shii-take mushrooms (Lentinus edodes) are produced per year. Different positive biological effects are known (anticarcinogenic, anticholesterol, immunostimulating effects), but the mineral contents and amino acid composition of caps and stipes are still little investigated. The concentrations of minerals are in general lower than those in the cultivated white mushroom (Agaricus bisporus) and in the oyster mushroom (Pleurotus ostreatus). The greatest differences are found in the concentrations of potassium, phosphorus, calcium, copper, strontium, manganese and zinc. The concentrations are higher in caps than in stipes. The total amino acid content is 15.24% in caps and 11.35% in stipes (dry matter) and thus in general half of the concentration of cultivated champignon. The amounts of Phe, Gly, His, Arg, Ile and Met are relative higher than in Agaricus fruit bodies.

PMID: 7571860, UI: 96035563

Biosci Biotechnol Biochem 1995 Jun;**59(6):**1169-1171

Purification and characterization of the 2nd 5'-nucleotide-forming nuclease from Lentinus edodes.

Kobayashi H, Inokuchi N, Koyama T, Tomita M, Irie M

The 2nd endonuclease (nuclease Le3) which hydrolyzes both RNA and heat denatured DNA to 5'-nucleotides was purified from the fruit bodies of Lentinus edodes to a homogeneous state by SDS PAGE. The nuclease was different from the nuclease Le1 previously characterized [H. Shimada et al. Chem. Pharm. Bull., 39, 2633-2637 (1991)] in molecular weight, optimal pH and N-terminal amino acid sequence. The N-terminal amino acid sequence of nuclease Le3 analyzed up to the 20th residue showed that 50% of the amino acid residues are identical to

nuclease Le1.

PMID: 7613009, UI: 95337563

Gene 1995 Feb 27;**154(1):**31-37

A fruiting body-specific cDNA, mfbAc, from the mushroom Lentinus edodes encodes a high-molecular-weight cell-adhesion protein containing an Arg-Gly-Asp motif.

Kondoh O, Muto A, Kajiwara S, Takagi J, Saito Y, Shishido K

A cDNA clone (designated mfbAc), encoding 2157 amino acids (aa), was isolated from a mature fruiting-body cDNA library of the edible mushroom Lentinus edodes. The mfbA transcript was abundant in mature fruiting bodies, detectable in immature fruiting bodies but absent in earlier developmental stages and in the vegetative mycelium. Although more abundant in the pileus than the stipe, only low levels were found in the gill tissue. The deduced MFBA protein (234.5 kDa) contained a cell-surface attachment-promoting Arg-Gly-Asp (RGD) motif. MFBA was produced in Escherichia coli using a maltose-binding protein (MBP) fusion vector, but it was cleaved into four fragments even in a protease-deficient host. A 425-aa MFBA peptide containing the RGD motif (named MFBA(582-1006) peptide) was successfully produced using the phage T7 expression system. This MFBA(582-1006) peptide exhibited a cell adhesion and spreading activity toward mammalian cells. This activity of the MFBA fragment was competitively inhibited by the Gly-Arg-Gly-Asp-Ser-Pro peptide but not by the Gly-Arg-Gly-Glu-Ser-Pro peptide, showing that the RGD motif of MFBA is essential for the cell-binding activity.

PMID: 7867945, UI: 95172398

Jpn J Cancer Res 1994 Dec;**85(12):**1298-1303

An in vivo study of hepatic and splenic interleukin-1 beta mRNA expression following oral PSK or LEM administration.

Morinaga H, Tazawa K, Tagoh H, Muraguchi A, Fujimaki M

The effects of orally administered biological response modifiers (BRMs) in preventing postoperative micro liver metastasis of primary colorectal cancer were examined in experimental animals. The two BRMs tested were Krestin (PSK) and Lentinus edodes mycelia (LEM). In previous experiments, we found that oral administration of PSK or LEM suppressed liver metastasis and prolonged the survival period. We also found that these agents elevated the liver natural killer (NK) and liver macrophage activities. In the present study in vivo, using reverse transcriptase-polymerase chain reaction (RT-PCR), we examined whether or not the liver and spleen have cytokines which would induce NK cells and macrophages, and whether or not the liver and spleen have cytokines induced by NK cells or macrophages. We placed emphasis on the examination of interleukin (IL)-1 beta expression in the liver and spleen in vivo. Two to six hours after oral administration of PSK or LEM (1 g/kg) to mice, IL-1 beta levels in the liver and spleen rose, and they returned to their baseline levels 24 h later. These findings suggest two possibilities: (1) hepatic IL-1 beta is potentiated by these agents soon after administration, resulting in activation of liver NK cells or macrophages, or (2) these agents stimulate IL-1 beta production by liver macrophages, and the produced IL-1 beta activates liver NK cells or liver macrophages (Kupffer cells). The results of this in vivo study suggest that the potentiation of hepatic and splenic IL-1 beta by PSK and LEM is involved in the early phases of suppression of micro liver metastases of colorectal cancer.

PMID: 7852192, UI: 95155165

Immunopharmacology 1994 Jul;**28(1):**77-85

Productions of interferon-gamma and nitrite are induced in mouse splenic cells by a heteroglycan-protein fraction from culture medium of Lentinus edodes mycelia.

Hibino Y, Konishi Y, Koike J, Tabata T, Ohashi Y, Sugano N

A xylose-rich heteroglycan-protein fraction (LAP1) was prepared from a solid culture medium in which Lentinus edodes mycelia were growing actively. Mouse splenic cells (SPs) were incubated with [3H]TdR in the presence of LAP1. The incubated SPs were fractionated into plastic adherent splenic cells (ADs), nylon-column effluent splenic cells (NEs) and sIg-expressed splenic cells (SIs), which are rich in Mac-1+, Thy-1.2+ and Ly-5+ cells, respectively. The incorporation of [3H]TdR in response to LAP1 was enhanced in each of the fractionated cell populations. Northern or dot blot hybridization showed that productions of IFN-gamma and its receptor mRNAs are induced predominantly in NEs. In another experiment, SPs were fractionated into ADs, NEs and SIs. Then, NE-AD, SI-AD and NE-SI mixtures were prepared and incubated in the same manner. A significant incorporation of [3H]TdR was shown only in the NE-AD mixture. The enzyme-linked immunosorbent assay showed that IFN-gamma production in response to LAP1 is induced in SPs or in the NE-AD mixture, but not in NEs alone. The level of the production was about 5 times higher in the mixture than in SPs after a 72 h incubation. Moreover, LAP1 was capable of inducing NO2- production in SPs. Thus, the present studies imply that this heteroglycan-protein fraction stimulates productions of IFN-gamma and nitrite in mouse splenic cells, augmenting antitumor immune response(s).

PMID: 7928304, UI: 95013281

Gene 1994 Feb 11;**139(1):**117-121

A novel cDNA, priBc, encoding a protein with a Zn(II)2Cys6 zinc cluster DNA-binding motif, derived from the basidiomycete Lentinus edodes.

Endo H, Kajiwara S, Tsunoka O, Shishido K

A cDNA clone (designated priBc) was isolated from a primordial cDNA library of the basidiomycete, Lentinus edodes (Le). The priBc clone consisted of 2628 bp encoding 565 amino acids. As was expected, the priB transcript was abundant in primordia, while preprimordial mycelia and mature fruiting bodies contained lower levels of this Le transcript. The deduced PRIB protein (64 kDa) contained a 'Zn(II)2Cys6 zinc cluster' DNA-binding motif. PRIB was produced in Escherichia coli using the bacteriophage T7 expression system. Southwestern blot analysis revealed that PRIB binds to the DNA fragment containing the upstream region of priB.

PMID: 8112580, UI: 94156172

Curr Genet 1994 Jan;**25(1):**30-33

Basidiomycetous ras cDNA functionally replaces its homolog genes in yeast.

Ishibashi O, Shishido K

It was shown by a plasmid exchange procedure that the Ras-encoding cDNA of the basidiomycete Lentinus edodes (named Leras cDNA) can functionally replace its homolog genes (ScRAS1 and ScRAS2) in the yeast Saccharomyces cerevisiae to maintain the viability of an yeast strain containing genetic disruptions of both RAS genes. The strain replaced by a Leras-cDNA-carrying plasmid, however, grew slower than the strains replaced by a ScRAS1- or a ScRAS2-carrying plasmid. The intracellular level of cAMP in the strain harboring the Leras-cDNA-carrying plasmid was clearly higher than that of a parental strain which maintains a plasmid carrying the S. cerevisiae cAMP-dependent protein kinase catalytic subunit C1 gene, TPK1, but was lower than that in a strain harboring an ScRAS2-carrying plasmid. These results suggest that the Leras cDNA can complement the ras1- ras2- mutation of yeast by virture of the stimulation of adenylate cyclase activity, although the complementation is not as efficient as that obtained by expressing the ScRAS2 gene.

PMID: 8082162, UI: 94363732

J Allergy Clin Immunol 1993 Aug;**92(2):**306-312

Basidiospore allergen release: elution from intact spores.

Horner WE, Levetin E, Lehrer SB

BACKGROUND: We sought to test the hypothesis that allergens are readily released by intact basidiospores in vitro and that different species release allergens in different patterns that are related to spore wall structure. METHODS: To assess basidiospore allergen releasability, basidiospore allergens were extracted from disrupted spores and eluted from intact spores, and the allergenic potency of the extracts and eluates was compared in Calvatia cyathiformis, Psilocybe cubensis, Lentinus edodes, and Pleurotus ostreatus. RESULTS: There was a significant species difference; on the basis of dry weight, the yield of extract and eluates from P1. ostreatus greatly exceeded the yield from C. cyathiformis extract and eluates. As measured by RAST inhibition, the allergenic potency of P1. ostreatus and L. edodes spore eluates reached the potency of disrupted spore extract in less than 4 hours. Allergen potency of Ps. cubensis and C. cyathiformis eluate approached the potency of disrupted spore extract only after 8 and 24 hours. Allergen staining intensity in sodium dodecyl sulfate polyacrylamide gel electrophoresis IgE immunoblot correlated with RAST activity. C. cyathiformis and Ps. cubensis spores have thick walls, whereas P1. ostreatus and L. edodes spore walls are thin and hyaline (nonpigmented). Thus spore allergen release may relate to spore wall characteristics. CONCLUSIONS: These studies indicate that intact basidiospores of all four species release allergens, but the release patterns differ by species, and these differences may be clinically significant.

PMID: 8349941, UI: 93352987

Antiviral Res 1993 Apr;**20(4):**293-303

Antiviral effect of the extract of culture medium of Lentinus edodes mycelia on the replication of herpes simplex virus type 1.

Sarkar S, Koga J, Whitley RJ, Chatterjee S

An extract of culture medium of Lentinus edodes mycelia, JLS-S001, significantly blocked the release of infectious herpes simplex virus type 1 (HSV-1) from African green monkey kidney cells. The block in replication was not due to the effect of JLS-S001 on the adsorption and penetration of HSV-1 to the monkey kidney cells. This observation was supported by the fact that JLS-S001 had no significant effect on the expression of virus-specific nucleocapsid proteins in the treated cells. Furthermore, electron microscopy demonstrated the presence of nucleocapsids within the nuclei of the infected and JLS-S001-treated cells. However, the expression of glycoproteins B, C, D, E and I was reduced in the JLS-S001-treated cells. These results suggested that JLS-S001 blocked HSV-1 replication at a

late stage in virus replication cycle probably in the assembly and budding of nucleocapsids and subsequent egress from the treated cells.

PMID: 8387258, UI: 93249287

Gene 1993 Mar 30;**125(2):**233-234

Nucleotide sequence of a ras gene from the basidiomycete Coprinus cinereus.

Ishibashi O, Shishido K

The basidiomycete Lentinus edodes (Le.) ras gene (or its cDNA clone) [Hori et al., Gene 105 (1991) 91-96] was utilized to identify and clone the corresponding gene (Cc.ras)-containing genomic fragment from the basidiomycete, Coprinus cinereus. Cc.ras encodes 215 amino acids (aa) interrupted by six small introns. The deduced Cc.RAS protein exhibits significant homology (84.7% identical) to the Le.RAS protein (217 aa) in size and aa sequence.

PMID: 8462879, UI: 93216129

Mol Gen Genet 1993 Feb;**237(1-2):**1-9

Bending of DNA segments with Saccharomyces cerevisiae autonomously replicating sequence activity, isolated from basidiomycete mitochondrial linear plasmids.

Nakajima M, Sheikh QI, Yamaoka K, Yui Y, Kajiwara S, Shishido K

Previous studies have indicated that DNA bending is a general structural feature of sequences (ARSs) from cellular DNAs of yeasts and nuclear and mitochondrial genomic DNAs of other eukaryotes that are capable of autonomous replication in Saccharomyces cerevisiae. Here we showed that bending activity is also tightly associated with S. cerevisiae ARS function of segments cloned from mitochondrial linear DNA plasmids of the basidiomycetes Pleurotus ostreatus and Lentinus edodes. Two plasmids, designated pLPO2-like (9.4 kb), and pLPO3 (6.6 kb) were isolated from a strain of P. ostreatus. A 1029 bp fragment with high-level ARS activity was cloned from pLPO3 and it contained one ARS consensus sequence (A/T)TTTAT(A/G)TTT(A/T) indispensable for activity and seven dispersed ARS consensus-like (10/11 match) sequences. A discrete bent DNA region was found to lie around 500 bp upstream from the ARS consensus sequence (T-rich strand). Removal of the bent DNA region impaired ARS function. DNA bending was also implicated in the ARS function associated with a 1430 bp fragment containing three consecutive ARS consensus sequences which had been cloned from the L. edodes plasmid pLLE1 (11.0 kb): the three consecutive ARSs responsible for high-level ARS function occurred in, and immediately adjacent to, a bent DNA region. A clear difference exists between the two plasmid-derived ARS fragments with respect to the distance between the bent DNA region and the ARS consensus sequence(s).

PMID: 8455547, UI: 93204881

Biosci Biotechnol Biochem 1992 Dec;**56(12):**2003-2010

Primary structure of a base non-specific and adenylic acid preferential

ribonuclease from the fruit bodies of Lentinus edodes.

Kobayashi H, Inokuchi N, Koyama T, Watanabe H, Iwama M, Ohgi K, Irie M

The complete primary structure of a base non-specific and adenylic acid preferential RNase (RNase Le2) from the fruit bodies of Lentinus edodes was analyzed. The sequence was mostly determined by analysis of the peptides generated by V8 protease digestion and BrCN cleavage (including alpha-chymotryptic, and V8 protease digest of BrCN fragments). It consists of 239 amino acid residues. The molecular weight is 25831. The location of 10 half cystine residues were almost superimposable on those of known fungal RNases of the RNase T2 family. The sequence homologies between RNase Le2 and four known fungal RNases of the RNase T2 family, RNase T2, RNase M, RNase Trv, and RNase Rh, are 102, 103, 109, and 74, respectively. The homologous sequences are concentrated around the three histidines, which are supposed to form the active site of RNase T2 family RNases.

PMID: 1369096, UI: 93129853

J Occup Med 1992 Nov;**34(11):**1097-1101

Mushroom worker's lung. Detection of antibodies against Shii-take (Lentinus edodes) spore antigens in Shii-take workers.

Van Loon PC, Cox AL, Wuisman OP, Burgers SL, Van Griensven LJ

Indoor cultivation of the edible mushroom Shii-take (Lentinus edodes) regularly leads to symptoms of mushroom worker's lung (MWL) in workers. An immunologic test is described allowing detection of IgG type antibodies against Shii-take spore antigens. It was found that MWL patients employed in Shii-take picking (n = 5) have significantly increased antibody titres against Shii-take spore antigens. Different control groups, viz, MWL patients employed in the cultivation of the white button mushroom Agaricus bisporus (n = 14) and of the oyster mushroom Pleurotus spp (n = 3), patients with Bechterew's syndrome (n = 7), sarcoidosis (n = 7), rheumatoid arthritis (n = 9), and healthy controls were found in the same range of low titres. The use of protective masks during picking reduced complaints of the workers (n = 14). However, their antibody titres increased with duration of employment despite the protection.

PMID: 1432300, UI: 93058025

Contact Dermatitis 1992 Aug;**27(2):**65-70

Shiitake (Lentinus edodes) dermatitis.

Nakamura T

Shiitake (Lentinus edodes) is a mushroom which is eaten in Chinese and Japanese meals and is nowadays the second most commonly produced edible mushroom in the world. Shiitake dermatitis was first described by Nakamura in 1977. This disease presents with very characteristic skin manifestations. From April 1974 to April 1991, I have observed 51 patients with shiitake dermatitis. The following description reviews the clinical manifestations, laboratory investigations and sources of shiitake dermatitis.

Publication Types:

- Review
- Review, tutorial

Published erratum appears in Contact Dermatitis 1992 Nov;27(5):351

PMID: 1395630, UI: 93009771

Immunopharmacology 1992 Jul;**24(1):**57-63

Mitogenic activities of heteroglycan and heteroglycan-protein fractions from culture medium of Lentinus edodes mycelia.

Tabata T, Watanabe W, Horita K, Kamegai J, Moriyama S, Hibino Y, Ohashi Y, Sugano N

The water soluble material (LEM) was prepared from the solid culture medium in which Lentinus edodes mycelia were growing actively. An alcohol insoluble material was prepared from LEM and subjected to Sepharose 6B gel filtration. The void fraction (LAP1) was composed mainly of xylose-rich heteroglycan and protein. From LAP1, a heteroglycan fraction (LAF1) was prepared by DEAE-Sepharose CL-6B column chromatography. LAP1 and LAF1 enhanced the incorporation of [3H]thymidine into mouse splenic cells (SPs). At each of the optimum doses, the rate of the incorporation was about 10 times as high with LAF1 as with LAP1. Such mitogenic responses were not induced in nylon-column effluent SPs and thymocytes. sIg-expressed cells were responsive to LAF1, but not to LAP1. Moreover, with each fraction, the incorporation was enhanced more in plastic adherent splenic cells (ADs) than in SPs. The flow cytometric assay revealed that the number of Mac-1+ cells is about 13 times as many in ADs as in SPs and that the number of Ly-5+ or Thy-1.2+ cells is considerably reduced in ADs compared with that in SPs. Thus, the present studies suggest that LAP1 and LAF1 act as mitogens predominantly for mouse splenic macrophages and/or monocytes.

PMID: 1452443, UI: 93084493

Gene 1992 May 15;**114(2):**173-178

Isolation and sequence of a developmentally regulated putative novel gene, priA, from the basidiomycete Lentinus edodes.

Kajiwara S, Yamaoka K, Hori K, Miyazawa H, Saito T, Kanno T, Shishido K

Screening for gene(s) homologous to v-Ha-ras (Harvey rat sarcoma viral ras gene) in the basidiomycete, Lentinus edodes, resulted in the isolation of a novel gene (designated priA), in addition to a ras gene homologue [Hori et al., Gene 105 (1991) 91-96]. The priA gene has a coding capacity of 258 amino acids (aa) interrupted by two short putative introns. The 5'-upstream region of priA contains GGGCGG box, CCAAT box, TATAAA box and CT sequence elements in 5'----3' order. One transcription start point (tsp) was located 10 nucleotides upstream from a TATAAA box and another tsp just in a CT sequence. The deduced PRIA protein (26.7 kDa), rich in Ser (42 residues), Pro (29 residues) and Thr (27 residues), contained different types of putative zinc-binding motifs. It initiated with a hydrophobic aa sequence and terminated with the unique sequence, Cys-Aaa-Aaa-Xaa (where Aaa is aliphatic aa and Xaa is any aa), implying an association with the inner membrane surface via acylation of the Cys residue. The priA gene expression was found to be developmentally regulated with primordia/immature fruiting bodies having much higher levels of priA transcript. Preprimordial mycelia and mature fruiting bodies, however, contain very low levels of priA transcript. The priA gene may play a role during the beginning of fruiting.

PMID: 1601301, UI: 92290272

FEMS Microbiol Lett 1992 Apr 15;**71(2):**147-150

Characterization of the promoter region of the basidiomycete Lentinus edodes Le.ras gene.

Kajiwara S, Shishido K

An analysis of the 2.7-kb nucleotide sequence including the 5'-flanking region of the basidiomycete Lentinus edodes Le.ras-encoding gene revealed that the promoter region contains a CAAT box, a CACCC box, two consecutive TATAAA boxes, and a CT-rich sequence element, in that order, from upstream to downstream. One major and two alternative transcriptional initiation sites are located 132 nucleotides and 85 and 90 nucleotides downstream from the downstream TATAAA box, and the major site is positioned just in the CT-rich sequence.

PMID: 1601285, UI: 92290251

Contact Dermatitis 1992 Apr;**26(4):**228-233

Allergic contact dermatitis in shiitake (Lentinus edodes (Berk) Sing) growers.

Ueda A, Obama K, Aoyama K, Ueda T, Xu BH, Li Q, Huang J, Kitano T, Inaoka T

A 42-year-old female shiitake grower was investigated to clarify the etiology of skin lesions which developed during the planting of shiitake hyphae into bed logs. She complained of repeated eczematous skin lesions during the planting season, from March to July, for 10 years. She handled 7,000 pieces of small conic blocks made of beech, with shiitake hyphae attached to their surface, per day, and 300,000 pieces altogether per season. She was positive on patch testing with extracts of shiitake hyphae. In contrast, female shiitake growers with skin lesions associated with work other than planting, and without skin lesions, were negative on patch testing to the hyphae. Moderate allergenicity was observed to extracts of shiitake hyphae in a guinea pig maximization test. These findings indicated the etiology of skin lesions in shiitake growers to be allergic contact dermatitis induced by shiitake hyphae.

PMID: 1395559, UI: 93009699

Nippon Eiseigaku Zasshi 1991 Oct;**46(4):**905-912

[Study on digestibility and energy availability of daily food intake].

[Article in Japanese]

Imaki M, Miyoshi T, Fujii M, Kojima T, Tada T, Sei M, Takahashi H, Yamasaki R, Fujita H, Oogimoto S, et al

The digestibilities of nutrients and energy in Shiitke mushrooms (Lentinus edodes) was measured in healthy adult males. A test diet was given for 5 days after 5 days on a basal diet which supplied 40g/day of protein and 45kcal/kg/day of energy. The test diet was identical with the basal diet except that shiitake was incorporated. Digestibility was calculated by the difference of fecal output between the test period and the basal period. The results obtained were follows: 1. Shiitake 60g/day intake level Digestibility of protein was 69.3 +/- 11.2%. Digestibility of fat was 66.6 +/- 24.9%. Digestibility of carbohydrate was 55.7 +/- 10.5%. The ratio of the total available energy to intake energy (Net Energy Availability) was 55.4 +/- 15.4%. 2. Shiitake 40g/day intake level Digestibility of protein was 85.5 +/- 23.8%. Digestibility of fat was 70.0 +/- 90.1%. Digestibility of carbohydrate was 65.8 +/- 13.1%. The ratio of the total available energy to intake energy (Net Energy Availability) was 67.4 +/-

25.9%.

PMID: 1749111, UI: 92085541

Chem Pharm Bull (Tokyo) 1991 Oct;**39(10):**2633-2637

Purification and characterization of a nuclease from Lentinus edodes.

Shimada H, Inokuchi N, Koyama T, Irie M

An endonuclease with 3'-nucleotidase activity (nuclease Le1) was purified from fruit bodies of Lentinus edodes in a single band on sodium dodecylsulfate-polyacrylamide gel electrophoresis (SDS-PAGE). The apparent molecular weight of nuclease Le1 was about 27000. The nuclease was inactivated in the presence of ethylenediaminetetraacetic acid (EDTA) and reactivated by the addition of Zn2+. Hydrolysis of poly U by the nuclease showed many intermediate size oligomers prior to the formation of 5'-uridine monophosphate (UMP). Therefore, it was concluded that nuclease Le1 was a Zn(2+)-endonuclease similar to P1-nuclease from Penicillium citrinum. The nuclease was very sensitive to ionic strength, but pH-profiles of the hydrolysis of four 3'-nucleotides were very similar to those of P1 nuclease from P. citrinum.

PMID: 1725278, UI: 92217114

Gene 1991 Aug 30;**105(1):**91-96

Cloning, sequence analysis and transcriptional expression of a ras gene of the edible basidiomycete Lentinus edodes.

Hori K, Kajiwara S, Saito T, Miyazawa H, Katayose Y, Shishido K

In the edible basidiomycete, Lentinus edodes, the presence of a high level of intracellular cyclic AMP (cAMP) is closely related to the onset of fruiting and/or primordium formation. Since a close relationship between intracellular cAMP levels and expression of ras genes was reported for organisms such as Saccharomyces cerevisiae and Dictyostelium discoideum, we have cloned and sequences a ras gene homologue from L. edodes (Le.), and analyzed its expression during development of the fungus. This gene, named Le.ras, has a coding capacity of 217 amino acids (aa) interrupted by six small introns. The deduced Le.Ras protein exhibited the highest homology to the Schizosaccharomyces pombe RAS protein (219 aa): 86% homology in the N-terminal 80-aa sequence and 74% homology in the next 80 aa. The Le.ras gene was transcribed at similar levels during mycelial development in fruiting-body formation, suggesting no direct correlation of Le.ras expression with intracellular cAMP levels in this organism.

PMID: 1937010, UI: 92039023

Sci Total Environ 1991 Jun;**105:**29-39

Concentrations of radiocesium and potassium in basidiomycetes collected in Japan.

Muramatsu Y, Yoshida S, Sumiya M

Concentrations of 137Cs, 134Cs and 40K in about 60 mushroom samples (fruit bodies of basidiomycetes)

belonging to 25 species collected in Japan have been studied. The levels of 137Cs varied very widely, ranging from less than 3 to 1520 Bq kg-1 (dry wt), while those of 40K were relatively constant. Concentrations of 137Cs in common edible mushrooms of Japan such as Lentinus edodes, Flammulina velutipes, Pleurotus ostreatus and Pholiota nameko were low (normally less than 50 Bq kg-1, dry wt). Concentrations of 134Cs in many samples were below the limit of detection (usually less than 5 Bq kg-1, dry wt). The median concentrations of 137Cs and 40K were 41 (dry wt) and 1150 Bq kg-1 (dry wt), respectively. From the 137Cs/40K ratios it was found that cesium rather than potassium was selectively taken up from the soils by fungi such as Suillus granulatus and Lactarius hatsudake. The 134Cs/137Cs ratios in mushrooms are related to the depth of the mycelium in the soil. The effective dose equivalent due to the dietary intake of radiocesium through mushrooms was estimated to be only 1.6 x 10(-7) Sv.

PMID: 1925522, UI: 92022497

Agric Biol Chem 1991 Apr;**55(4):**1167-1169

Purification and characterization of a base non-specific and adenylic acid preferring ribonuclease from the fruit bodies of Lentinus edodes.

Shimada H, Inokuchi N, Okuwaki H, Koyama T, Irie M

PMID: 1368676, UI: 91254740

Neth J Med 1991 Feb;**38(1-2):**59-64

Provocation tests in extrinsic allergic alveolitis in mushroom workers.

Kamm YJ, Folgering HT, van den Bogart HG, Cox A

The clinical diagnosis of extrinsic allergic alveolitis can be supported by a positive provocation test. Twenty-eight common mushroom (Agaricus bisporus) workers, 4 oyster mushroom (Pleurotus ostreatus) workers and 6 Shii Take mushroom (Lentinus edodes) workers, whose medical history indicated a possible extrinsic allergic alveolitis, were examined. The provocation test consisted of a control day, an exposure day, and half a day of follow-up observation. On the control and exposure days, the body temperature, leucocyte count and lung function were measured every 2 h. The chest X-ray and arterial blood gas sample were taken once. The exposure consisted of a 1-h presence on the common mushroom farm in spawning conditions or inhaling a suspension of spores of Pleurotus or Shii-Take in the laboratory. Eighteen of the 28 people employed on the common mushroom farm, all 4 Pleurotus workers and 4 of the 6 Shii-Take workers were diagnosed as having extrinsic allergic alveolitis, according to the following criteria: a positive history and 2 or more of the following findings: increase in leucocyte count, rise in temperature and decrease in inspiratory vital capacity (IVC) and total lung capacity (TLC).

PMID: 2030812, UI: 91232682

Eisei Shikenjo Hokoku 1991;**109:**98-99

[Survey of radiocesium in domestic mushrooms on the market].

[Article in Japanese]

Kawamura Y, Uchiyama S, Saito Y

Domestic mushrooms on the market were tested for concentration of radiocesium; cesium-134 and 137 by gamma-ray spectrometer. Cesium-137 was detected in most samples of dried and raw shiitake (Lentinus edodes (Berk.) Sing.). The concentrations were from 6.7 to 73.9 Bq/kg in dried ones and from 1.3 to 6.4 Bq/kg in raw ones. It was not detected in enokitake (Flammulina veltipes (Fr.) Sing.) and shimeji (Lyophyllum aggregatum (Secr.) Kuhner and Pleurotus ostreatus (Fr.) Quel.). Cesium-134 was not found in all samples.

PMID: 1364413, UI: 95004447

Agric Biol Chem 1990 Jun;**54(6):**1611-1613

Morphological changes of tumor cells caused by macrophages treated with lignin derivatives.

Sorimachi K, Yamazaki S, Toda S, Yasumura Y

PMID: 1368572, UI: 91103967

Appl Microbiol Biotechnol 1990 Jun;**33(3):**359-365

Characteristics and N-terminal amino acid sequence of a manganese peroxidase purified from Lentinula edodes cultures grown on a commercial wood substrate.

Forrester IT, Grabski AC, Mishra C, Kelley BD, Strickland WN, Leatham GF, Burgess RR

Extracellular culture filtrates from ligninolytic cultures of the lignin-degrading basidiomycete Lentinula (syn. Lentinus) edodes (Berk.) Pegler contained one major peroxidase when grown on a commercial oak-wood substrate. The peroxidase was purified by polyethylenimine clarification, anion-exchange chromatography, and hydrophobic-interaction HPLC. The enzyme (MnP1) was a heme-iron protein with an apparent molecular weight of 44,600 on sodium dodecyl sulfate-polyacrylamide gel electrophoresis gels and an isoelectric point of pH 3.2. The native enzyme had an absorption maximum at 407 nm, which shifted to 420 nm upon H2O2 addition. The pyridine-hemochrome-absorption spectrum indicated that one heme group was present per enzyme as protoporphyrin IX. N-Terminal amino acid sequencing showed that MnP1 had higher sequence homology with manganese peroxidases than with lignin peroxidases reported from Phanerochaete chrysosporium. L. edodes MnP1 was capable of oxidizing lignin and lignin-model compounds in the presence of manganese and H2O2.

PMID: 1366641, UI: 91025913

Nucleic Acids Res 1990 Mar 25;**18(6):**1395-1400

The basidiomycete Lentinus edodes linear mitochondrial DNA plasmid contains a segment exhibiting a high autonomously replicating sequence activity in Saccharomyces cerevisiae.

Katayose Y, Kajiwara S, Shishido K

A linear DNA plasmid, designated pLLE1, has been isolated from a mitochondrial fraction of a strain of Lentinus

edodes. pLLE1(11.0 kbp) was sensitive to the 3'----5'-acting exonuclease III and resistant to the 5'----3'-acting lambda exonuclease. It showed no homology with mitochondrial and nuclear genomic DNAs of plasmidless strain as well as the pLLE1-harboring host strain of L. edodes. The 1434-bp fragment (sequences) capable of autonomous replication in the yeast Saccharomyces cerevisiae (ARSs) was cloned from pLLE1 DNA with YIp32 (pBR322 containing yeast LEU2 DNA), which displayed a high ARS activity. The cloned 1434-bp fragment was shown to lie near to the end of pLLE1 DNA (nucleotides about 800-2200) and contained three consecutive ARS consensus sequences (A/T)TTTAT(A/G)TTT(A/T) of S. cerevisiae and dispersive eight ARS consensus-like sequences. The subcloned 366-bp fragment containing the three ARSs retained original ARS activity of the 1434-bp fragment.

PMID: 2183190, UI: 90221860

Agric Biol Chem 1990 Feb;**54(2):**479-487

Structural characterization of the immunoactive and antiviral water-solubilized lignin in an extract of the culture medium of Lentinus edodes mycelia (LEM).

Suzuki H, Iiyama K, Yoshida O, Yamazaki S, Yamamoto N, Toda S

The active principle of EP3, a fraction from an extract of the culture medium of Lentinus edodes mycelia (LEM), which activates murine macrophages, causes proliferation of bone marrow cells, and inhibit the replication of Human Immunodeficiency Virus in vitro, was characterized as a water-solubilized lignin. The detailed structural feature of this water-solubilized lignin was investigated and shown to be a highly condensed and polycarboxylated lignin which is denatured and solubilized by Lentinus edodes from bagasse. The water-solubilized lignin itself was confirmed to have both immunological activities and the antiviral activity.

PMID: 1368512, UI: 90334853

Eur Surg Res 1990;**22(6):**340-346

Modification of septic processes by beta-glucan administration.

Tsujinaka T, Yokota M, Kambayashi J, Ou MC, Kido Y, Mori T

The effect of glucan (lentinan), beta(1----3)-glucan derived from Lentinus edodes, was evaluated in a clinically relevant septic model. Male, Japanese, white rabbits were intravenously injected with lentinan (1 mg/body) just before septic insult, induced by injecting fecal suspension into the ligated choledochus. In septic animals without lentinan treatment, platelet counts dropped serially following the septic insult and a paracoagulation test, measured by protamine gelation, turned positive. Plasma bilirubin and creatinine elevated significantly in comparison with control animals injected with saline, at 9 h and at 6 and 9 h. respectively. In lentinan-treated septic animals, platelet counts did not decrease and a significant difference was found at 9 h, compared to the untreated septic animals. The degree of positive paracoagulation was less prominent. The elevation of plasma bilirubin and creatinine levels was also less prominent and a significant difference was found at 9 h. Plasma endotoxin elevated significantly at 9 h in the untreated septic animals in comparison with lentinan-treated septic and control animals. The findings suggest a modification of the septic processes by the administration of glucan.

PMID: 2079094, UI: 91177059

Clin Exp Allergy 1990 Jan;**20(1):**13-19

Respiratory and immunological reactions among Shiitake (Lentinus edodes) mushroom workers.

Sastre J, Ibanez MD, Lopez M, Lehrer SB

Four workers, the total work force employed at a Shiitake farm, developed cough and sputum production following a variable period of exposure to Shiitake mushrooms. All four had abnormal diffusing capacity and three had abnormal spirometry values. Chest roentgenograms demonstrated an interstitial pattern in one worker. Pulmonary function tests performed before and during several days of work demonstrated a significant decrease (greater than 20%) in forced vital capacity (FVC) and/or maximal mid-expiratory flow (MMEF) in three workers. Although specific antibodies to an extract of Shiitake spores were detected in sera from three workers none were IgE. High levels of Shiitake spores were detected in growing rooms (greater than 10(6)/m3) as well as other locations at the farm. Shiitake spore airborne antigen, detected by an immunochemical assay, was present in dust collected with a volumetric sampler from different locations at the farm. Antigenic determinants of Shiitake spore antigens, in common with antigens from other cultivated mushrooms (Agaricus and Pleurotus) were demonstrated by ELISA inhibition assay. This study demonstrates that workers exposed to high levels of Shiitake spores develop symptoms and laboratory findings suggestive of hypersensitivity pneumonitis (HP). Strict environmental control and the wearing of a face mask is probably needed to reduce the high risk of sensitization and possible development of immunological lung disease. Shiitake spores must be considered as an aetiological agent of mushroom workers' lung.

PMID: 1967128, UI: 90182304

Biochem Biophys Res Commun 1989 Apr 14;**160(1):**367-373

Inhibition of the infectivity and cytopathic effect of human immunodeficiency virus by water-soluble lignin in an extract of the culture medium of Lentinus edodes mycelia (LEM).

Suzuki H, Okubo A, Yamazaki S, Suzuki K, Mitsuya H, Toda S

Inhibition of the infectivity and cytopathic effect of human immunodeficiency virus type 1 (HIV-1) by the immunoactive fractions obtained from LEM, which is an extract of the culture medium of Lentinus edodes mycelia, is reported. A purified fraction, EPS4, obtained from LEM by ethanol precipitation followed by hydrophobic chromatography and gel filtration chromatography completely inhibited the HIV-1 induced cytopathic effect in vitro at concentrations of greater than or equal to 10 micrograms/ml. Chemical and spectral analysis revealed that EPS4 is composed of water-soluble lignins containing minor amounts of protein (3.2%) and sugars (12.2%). Taken together with the previously reported observation that EPS4 promotes the activation of macrophages and the proliferation of bone marrow cells, the fraction appears to possess both an immunostimulating activity and an anti-HIV effect in vitro.

PMID: 2469420, UI: 89228040

Biochim Biophys Acta 1989 Feb 6;**1001(2):**185-190

Molecular species of cerebrosides in fruiting bodies of Lentinus edodes and their biological activity.

Kawai G

Cerebroside fraction was obtained from fresh fruiting bodies of Lentinus edodes and separated into ten molecular species by reverse-phase high-performance liquid chromatography. The species were identified by GLC, GC-MS and NMR. Their component glycosides and sphingoids were uniformly glucose and (4E,8E)-9-methyl-4,8-sphingadienine, respectively. The component fatty acids were 2-hydroxy acids with the carbon chain length of 16, 15, 14, 18, 24, 17, 25, 26, 22 and 23 (from major to minor). The cerebrosides with the C14-18 fatty acids showed strong fruiting-inducing activity in Schizophyllum commune. Those with the C22 and C23 ones had one-eighth and one-sixteenth of the activity, respectively, and those with C24-26 had no detectable activity. 22 and 23 must be the carbon chain lengths of the component fatty acid of the sphingolipids critical for expression of biological activity.

PMID: 2917142, UI: 89134763

Vopr Pitan 1989 Jan;**1:**16-19

[Anti-atherosclerotic properties of higher mushrooms (a clinico-experimental investigation)].

[Article in Russian]

Li Khva Ren, Vasil'ev AV, Orekhov AN, Tertov VV, Tutel'ian VA

Antiatherosclerotic properties of water and alcoholic extracts of 20 types of high-species mushrooms were investigated by evaluation of intracellular cholesterol accumulation and 3H-thymidine inclusion into the cells of the human aortal intima in culture. The influence of a single intake of some mushroom species on antiatherosclerotic properties of the human sera was studied. It has been shown that Ganoderma lucidum and Lentinus edodes possess pronounced antiatherosclerotic properties.

PMID: 2718411, UI: 89243251

J Acquir Immune Defic Syndr 1989;**2(5):**441-447

Antiviral agents with activity against human retroviruses.

Tochikura TS, Nakashima H, Yamamoto N

The ability of various known anti-HIV antivirals to inhibit four different strains of human immunodeficiency virus type 1 (HIV-1), a strain of type 2 (HIV-2), and a human T-cell lymphotropic virus type I (HTLV-I) was tested. The tested substances included two sulfated polysaccharides (lentinan sulfate and dextran sulfate) and a nonsulfated polysaccharide PSK, E-P-LEM, glycyrrhizin sulfate, and nucleoside analogues (AZT and DHT). The effects of the substances were measured quantitatively with two different assays: (i) inhibition of cell-free viral infection and (ii) inhibition of the fusion reaction induced by cell-to-cell infection. The results showed that cell-free infection of HIV-1 and HIV-2 was almost completely blocked in the presence of all of the substances tested. However, cell-to-cell infection by HIV-1, HIV-2, and HTLV-I was inhibited only by the polysaccharides, E-P-LEM, and glycyrrhizin sulfate but not by the two nucleoside analogues. Moreover, the extent of inhibition of the fusion reaction by the substances varied significantly from strain to strain in HIV-1.

PMID: 2477523, UI: 90011748

Nippon Shokakibyo Gakkai Zasshi 1988 Jul;**85(7):**1430

[Immunopotentiating substances in Lentinus edodes mycelial extract (LEM)--activation of macrophage and proliferation of bone marrow cell].

[Article in Japanese]

Suzuki H, Okubo A, Yamazaki S, Toda S

PMID: 3184514, UI: 89037769

Med Microbiol Immunol (Berl) 1988;**177(5):**235-244

Inhibition (in vitro) of replication and of the cytopathic effect of human immunodeficiency virus by an extract of the culture medium of Lentinus edodes mycelia.

Tochikura TS, Nakashima H, Ohashi Y, Yamamoto N

An extract of culture medium of Lentinus edodes mycelia (LEM) was prepared. This was further fractionated by 50% ethanol precipitation and both the resulting product, E-P-LEM, and LEM were studied to evaluate their effect on the activity of human immunodeficiency virus (HIV) in vitro. The experiments were performed using either a cell-free infection system with MT-4 cells, or a cell-to-cell infection system with MOLT-4 cells, which induces multinucleated giant cells very efficiently. E-P-LEM almost completely blocked both the cytopathic effect of giant cell formation and specific antigen expression due to HIV, whereas LEM before ethanol precipitation blocked the expression of HIV antigen in MT-4 cells only at a high concentration. Pretreatment of the virus with E-P-LEM before infection blocked HIV infection in the target cells. Thus, the inhibitory effect of LEM and E-P-LEM on HIV could be due to a blocking of the initial stages of HIV infection. Moreover, reverse transcriptase activity of avian myeloblastosis virus was inhibited.

PMID: 3173237, UI: 89014155

J Nutr Sci Vitaminol (Tokyo) 1987 Oct;**33(5):**341-346

Effect of shiitake (Lentinus edodes) and maitake (Grifola frondosa) mushrooms on blood pressure and plasma lipids of spontaneously hypertensive rats.

Kabir Y, Yamaguchi M, Kimura S

To study the effect of Shiitake (Lentinus edodes) and Maitake (Grifola frondosa) on hypertension, spontaneously hypertensive rats (SHR) were fed a diet containing 5% mushroom powder and 0.5% NaCl solution as drinking water for 9 weeks. The dietary mushrooms decreased the blood pressure. The plasma free cholesterol level decreased in Shiitake-fed animals, whereas in Maitake-fed animals the total cholesterol level decreased. There was no difference in the plasma triglyceride and phospholipid levels among the experimental groups. Shiitake feeding resulted in a decrease in VLDL- and HDL-cholesterol whereas Maitake feeding caused a decrease in

VLDL-cholesterol only. Plasma LDL-cholesterol was not affected by dietary mushrooms. The results suggest that dietary mushrooms prevent blood pressure increase in hypertension.

PMID: 3443885, UI: 88171777

Gastroenterol Jpn 1987 Oct;**22(5):**627-632

Effects of extract of cultured Lentinus edodes mycelia (LEM) on polyclonal antibody response induced by pokeweed mitogen.

Mizoguchi Y, Katoh H, Kobayashi K, Yamamoto S, Morisawa S

When polyclonal antibody response induced by pokeweed mitogen (PWM) was estimated by measuring antibody-forming cells produced against trinitrophenylated sheep red blood cells (TNP-SRBC) using hemolytic plaque assay, it was found to be augmented by the extract of cultured Lentinus edodes mycelia (LEM). Since some factor enhancing antibody response was detected in the culture supernatant of LEM-treated macrophages, this was fractionated by gel filtration, which revealed a substance with a molecular weight of about 15,000 daltons. This suggested that interleukin-1 (IL-1) was produced, and that it had caused, at least partially, the enhancement of antibody response. This possibility was confirmed by the direct assay of IL-1 activity, which demonstrated increased DNA synthesis in PHA-stimulated thymocytes.

PMID: 3315820, UI: 88056106

Gastroenterol Jpn 1987 Aug;**22(4):**459-464

Protection of liver cells against experimental damage by extract of cultured Lentinus edodes mycelia (LEM).

Mizoguchi Y, Katoh H, Kobayashi K, Yamamoto S, Morisawa S

Liver cell damage can be induced when isolated liver cells coated with specific antibodies against the liver cell membrane are cultured with peripheral blood mononuclear cells. Although this antibody-dependent cell-mediated cytotoxicity (ADCC) is dependent on the close contact of effector cells with target cells via specific antibodies, a cytotoxic factor or factors causing the inhibition of protein synthesis in liver cells has been detected in the culture supernatant from the ADCC reaction. Similarly, peritoneal exudate macrophages activated by endotoxin lipopolysaccharide also exert cytotoxic effects on isolated liver cells by production of a cytotoxic substance or substances. The liver cell damage caused by either the ADCC or activated macrophage culture supernatants were significantly reduced by pretreating the isolated liver cells with the extract of cultured Lentinus edodes mycelia (LEM). These results suggest that LEM may protect liver cells from immunological damage.

PMID: 3311866, UI: 88030543

Chem Pharm Bull (Tokyo) 1987 Jun;**35(6):**2453-2458

Antitumor action of shiitake (Lentinus edodes) fruit bodies orally administered to mice.

Nanba H, Mori K, Toyomasu T, Kuroda H

PMID: 3664842, UI: 88027328

Chung Hua Chung Liu Tsa Chih 1987 Mar;**9(2):**109-111

[Effect of six edible plants on the development of AFB1-induced gamma-glutamyltranspeptidase-positive hepatocyte foci in rats].

[Article in Chinese]

Chen ZY, Yan RQ, Qin GZ, Qin LL

Six edible plants, green tea (GT), black tea (BT), Lentinus edodes (berk) Sing (LE), Hericium erinaceus (Bull. ex Fr.) Pers. (HE), Mixture of Ganoderma Lucidum (Ley ss ex Fr.) Karst et Ganoderma Japanium (Fr.) Lloyd (MGLJ) and mung bean (MB), were tested for the effect on the development of AFB1-induced gamma-glutamyltranspeptidase positive hepatocyte foci (gamma-GT foci) using an in vivo short-term test model in rats. The rats received intraperitoneally 12 doses of initiator AFB1, 400 micrograms/kg per dose for 2 successive weeks. Two weeks after the initiation, the rats were submitted to a modified "Solt-Farber promotion program", i.e., a two weeks' feeding of a diet containing 0.015% acetylaminofluorene plus a two-third partial hepatectomy (PH) on day 7. The rats were sacrificed 10 days after PH and the livers were processed to gamma-glutamyltranspeptidase staining. The tested substances were powdered and mixed with the basal diet at the concentration level of 30% for MB and 5% for the others. The rats were fed with the diet-containing tested substances from 10 days before the AFB1 initiation to 3 days after the AFB1 conclusion. Consequently, the liver of the rats which had consumed GT showed significantly less and smaller gamma-GT foci, and those which had consumed BT, HE and LE showed somewhat less and significantly smaller foci than the control groups. It is indicated that the four diets have an inhibiting effect on AFB1-induced gamma-GT foci in different degrees. MB and MGLJ show no significant influence on the foci.

PMID: 2443327, UI: 88003983

Nat Immun Cell Growth Regul 1987;**6(3):**116-128

Low natural killer syndrome: clinical and immunologic features.

Aoki T, Usuda Y, Miyakoshi H, Tamura K, Herberman RB

Twenty-three patients with low natural killer syndrome (LNKS), 7 males and 16 females, are reported here. These LNKS patients had an age range from 14 to 77 years, with a median of 36.5 years. LNKS is a newly proposed category of immune disorders, being characteristically diagnosed by lowered NK cell activity against K562 target cells as a definite laboratory abnormality, in association with general clinical symptoms of remittent fever and uncomfortable fatigue, persisting without explanation for more than 6 months. Other immune parameters, such as the DNA synthesis of peripheral blood mononuclear cells (PBMCs) in either the presence or absence of mitogens, the T4+/T8+ ratio and the number of Leu-11+ PBMCs, were usually within the normal range. Also, routine laboratory tests did not detect any abnormal findings. The LNKS patients responded well to the administration of an immunopotentiator called 'lentinan', a glucan extracted from the Japanese mushroom Lentinus edodes, despite no responses to conventional fever treatments such as the administration of antipyretics or antibiotics. All LNKS patients observed were universally free of antibodies in their sera to human T-lymphotropic retroviruses I and III, and lymphadenopathy was infrequent, indicating that the LNKS is a syndrome independent of acquired immunodeficiency syndrome (AIDS) or AIDS-related complex. Antibodies to other known viruses tested such as Epstein-Barr or measles virus, or cytomegalovirus were also negative or not significantly elevated in the sera before the initiation of lentinan administration. If a virus is the cause of LNKS, it may be a new, unknown virus or an

unknown substrain of known viruses. None of the LNKS patients has died of this syndrome.

PMID: 2442602, UI: 87315101

Biochem Biophys Res Commun 1986 Aug 14;**138(3):**1110-1115

Cloning of Lentinus edodes mitochondrial DNA fragment capable of autonomous replication in Saccharomyces cerevisiae.

Katayose Y, Shishido K, Ohmasa M

Mitochondrial (mt) DNA of the higher basidiomycetes Lentinus edodes with a molecular weight of about 69 kb was partially digested with Sau3AI, cloned with plasmid YIp32 (a hybrid of pBR322 and the yeast leu2 gene) and analyzed for sequences capable of autonomous replication (ARSs) in the eukaryote Saccharomyces cerevisiae. One recombinant plasmid was isolated which contained 3.2 kb fragment of the mtDNA with ARS activity. This plasmid (named pSK52) exhibited a high-frequency yeast transformation and was found to be maintained within the cell as an extrachromosomal element. The stability and copy number properties of pSK52 were similar to those of the recombinant plasmid of YIp32 and S. cerevisiae mt-ARS constructed as a reference. Subcloning experiments were carried out to assess the localization of ARS on the above 3.2 kb fragment, revealing that the fragment contains at least two ARSs.

PMID: 3530252, UI: 86323162

Jpn J Med Sci Biol 1986 Apr;**39(2):**35-47

Triton WR-1339 as a biological-response modifier in mycobacterial infection.

Kondo E, Kanai K

A non-ionic detergent, Triton WR-1339, prolonged markedly the survival time of mice infected fatally with virulent mycobacteria, though it exerted only a limited effect on the fate of tissue viable counts. The combined administration of Triton WR-1339 with lentinan (a glucan purified from the Japanese mushroom Lentinus edodes) was more effective than the single administration of each. This detergent was not lytic to red blood cells or lysosomes, but its substantial effect on the biomembrane was suggested by cold-shock experiment of hemolysis. It was considered that Triton WR-1339 is a biological-response modifier, possibly altering the interaction between the mycobacterial surface and the membrane structure of phagocytes.

PMID: 3773303, UI: 87037377

Hautarzt 1985 Oct;**36(10):**591-593

[Toxicodermia cause by the edible mushroom shiitake].

[Article in German]

Nakamura T, Kobayashi A

Shiitake is a kind of mushroom (Lentinus edodes) which is eaten in Chinese and Japanese meals all over the world.

In the last 9 years, we have observed 30 patients with toxicodermia caused by eating Shiitake. Toxicodermia caused by Shiitake has a characteristic clinical picture.

PMID: 4066320, UI: 86058635

Chung Yao Tung Pao 1985 Aug;**10(8):**7-8

[Culture identification and purification of polysaccharide proteins in Lentinus edodes and Polystictus versicolo].

[Article in Chinese]

Li ZL

PMID: 2937576, UI: 86162009

Cancer Lett 1985 May;**27(1):**1-6

Anticarcinogenic action of an alcohol-insoluble fraction (LAP1) from culture medium of Lentinus edodes mycelia.

Sugano N, Choji Y, Hibino Y, Yasumura S, Maeda H

From the culture medium of Lentinus edodes mycelia, water-soluble material (LEM) was prepared and further fractionated by alcohol precipitation and gel filtration on Sepharose 6B. The resulting fraction of xylose-rich proteoglycan at the void volume was designated as LAP1. The 25% and 50% survival rates of hepatoma-bearing rats were raised by intraperitoneal (i.p.) administration of LAP1 at doses of 3-10 mg/kg (an optimum dose, 3 mg/kg). This fraction did not suppress in vitro cell proliferation of the hepatoma. Moreover, the i.p. administration of LAP1 significantly augmented the activity of macrophage-migration inhibition of the splenic cells from hepatoma-bearing rats in the early stage after transplantation. Thus, the anticarcinogenic action of LAP1 would partly be interpreted by host-dependent immunomodulation.

PMID: 4039972, UI: 85227939

Kobe J Med Sci 1984 Aug;**30(3-4):**25-34

Isolation and antiviral activities of the double-stranded RNA from Lentinus edodes (Shiitake).

Takehara M, Toyomasu T, Mori K, Nakata M

PMID: 6210395, UI: 85084428

Acta Med Okayama 1984 Feb;**38(1):**49-55

Antitumor effect of bacterial lipopolysaccharide (LPS) alone and in

combination with lentinan on MH-134 tumors in C3H/He mice.

Moriya N, Miwa H, Orita K

Using C3H/He mice, the antitumor effect of lipopolysaccharide (LPS) alone and in combination with Lentinan extracted from Lentinus edodes was studied. The influence of LPS on cellular immunity and the antitumor effect of the tumor necrosis factor (TNF) were also examined. LPS, which was administered into mice with tumor, induced hemorrhagic necrosis of the tumor within 48 h, demonstrating a high antitumor effect. When LPS was used in combination with Lentinan, the tumor growth was significantly inhibited as compared to that in the control mice. The combination of LPS and Lentinan prevented a decrease in the delayed type hypersensitivity in tumor bearing mice. Application of rabbit serum containing TNF resulted in hemorrhagic necrosis of the tumor within 48 h, as with LPS.

PMID: 6702486, UI: 84150010

Rocz Panstw Zakl Hig 1984;**35(1):**59-62

[Nutritive value of the mushroom Lentinus edodes (Berk.) Sing. (shiitake) compared with that of other edible mushrooms].

[Article in Polish]

Brodziak L, Majchrzak R

PMID: 6538987, UI: 84196016

Gan To Kagaku Ryoho 1983 Feb;**10(2 Pt 2):**387-393

[Effects of lentinan in advanced or recurrent cases of gastric, colorectal, and breast cancer].

[Article in Japanese]

Taguchi T

In order to evaluate clinical efficacy of Lentinan (LNT), a purified polysaccharide extracted from Lentinus edodes, randomized controlled studies with envelope method have been conducted on the patients with advanced or recurrent, stomach, colo-rectal and breast cancer. Administration condition of LNT for gastrointestinal cancer was designed as the following: LNT was administered intravenously at doses of 1 mg/person/day twice a week or 2 mg/person/day once a week in combination with mitomycine C + 5-FU (MF) or tegafur (FT). Control therapy was the administration of MF or FT alone. Survival curve drawn by Kaplan-Meier's method showed that life span prolongation effect of LNT was observed with statistical significance (P less than 0.05 or P less than 0.01) by use of generalized Wilcoxon's test. Moreover, improvement of host immune responses was observed in LNT treated group, and hematological survey showed that incidence rate of abnormal value was significantly low in LNT treated group. Thus, LNT should be effective for the patients with advanced or recurrent stomach or colo-rectal cancer in combination with chemotherapeutic agents such as MF or FT. Regarding advanced or recurrent breast cancer, study is underway. LNT has been administered as an agent for supportive therapy to the patients with complete response, partial response or stable diseases which were induced by prior surgery of oophorectomy. Again, life span prolongation effect of LNT has been observed with statistical significance (P less than 0.05). This

result suggests that LNT would also be effective for the patients with advanced or recurrent breast cancer as an agent for supportive therapy.

Publication Types:

- Clinical trial

PMID: 6349538, UI: 83281658

Virology 1982 Nov;**123(1):**93-101

Ultrastructural features of fungal virus-like particles from Lentinus edodes.

Ushiyama R, Nakai Y

PMID: 7147717, UI: 83069311

Cancer Lett 1982 Nov;**17(2):**109-114

Anticarcinogenic actions of water-soluble and alcohol-insoluble fractions from culture medium of Lentinus edodes mycelia.

Sugano N, Hibino Y, Choji Y, Maeda H

The water-soluble (LEM) and alcohol-insoluble (LAP and LAP1) fractions were prepared from the culture medium of Lentinus edodes mycelia which was composed of bagasse and rice bran. LEM suppressed rat hepatocarcinogenesis and its cell proliferation of rat-ascites hepatoma to about 50% or less of each control group. LAP also suppressed cell proliferation at almost the same rate. LAP1 induced many small cells in the ascites and significantly raised the survival rate of hepatoma-bearing rats. Thus, anticarcinogenic action was revealed in LAP or LAP1 fractions which were mainly composed of xylose-containing polysaccharide and protein.

PMID: 6891904, UI: 83155146

Gan To Kagaku Ryoho 1982 Aug;**9(8):**1474-1481

[Effect of lentinan administration of adrenalectomized rats and patients with breast cancer].

[Article in Japanese]

Kosaka A, Wani T, Hattori Y, Yamashita A

To investigate a clinical application of Lentinan, an immunomodulator and polysaccharide extracted from Lentinus edodes, an effect of Lentinan on the adrenalectomized rats was examined. The multiple injection of Lentinan did not result in any changes in the growth curves, survival rate nor histamine sensitivity, compared with those of the controls, indicating that Lentinan might be a useful agent in the combination therapy of adrenalectomized animals. The clinical safety of Lentinan administration for the patients with advanced or recurrent breast cancer who

received bilateral oophorectomy and adrenalectomy were confirmed, and its efficacies were evaluated by prolongation of life span and antitumor effect. The improvement of prognosis was observed in Lentinan treated patients, compared with the control.

Publication Types:

- Clinical trial

PMID: 6764117, UI: 83255296

Food Chem Toxicol 1982 Jun;**20(3):**265-267

The mutagenicity of some edible mushrooms in the Ames test.

von Wright A, Knuutinen J, Lindroth S, Pellinen M, Widen KG, Seppa EL

The mutagenic activity of five wild and two cultivated species of edible mushrooms was studied in the Ames Salmonella/microsome test system. The wild mushrooms tested were four species of the genus Lactarius (L. necator, L. torminosus, L. helvus and L. rufus) and bolete (Boletus edulis). The cultivated species were champignon (Agaricus bisporus) and shiitake (Lentinus edodes). All the mushrooms were mutagenic to tester strains sensitive to base-pair substitution mutagens, and L. necator, L. rufus and B. edulis also had some frameshift activity. Metabolic activation was not required and the mutagenic activity could be detected even in boiled mushroom extracts. After fractionation with organic solvents (ethanol followed by diethyl ether) the activity was recovered in the ether phase as well as the aqueous phase in the case of L. necator, but remained in the aqueous phase of the A. bisporus and Lentinus edodes extracts.

PMID: 7201952, UI: 82263082

Chem Pharm Bull (Tokyo) 1982 Apr;**30(4):**1134-1140

Studies on Basidiomycetes. I. Antitumor polysaccharide from bagasse medium on which mycelia of Lentinus edodes (Berk.) Sing. had been grown.

Togami M, Takeuchi I, Imaizumi F, Kawakami M

PMID: 7201888, UI: 82259558

J Biochem (Tokyo) 1981 Oct;**90(4):**1093-1100

Structure of the alkali-insoluble skeletal glucan of Lentinus edodes.

Shida M, Ushioda Y, Nakajima T, Matsuda K

An alkali-insoluble core material was isolated from the fruit bodies of Lentinus edodes after exhaustive extraction with 24% NaOH at 5 degrees C. This material consists mainly of glucan which is closely associated with chitin. Methylation analysis has shown that the glucan part of the core material (skeletal glucan) has a highly branched structure with 1,6 and 1,3 linkages in a molar ratio of 2 : 1. Stepwise enzymatic hydrolysis with basidiomycete sp. QM 806 beta-1,3-glucanase has indicated the heterogeneity of the skeletal glucan. The outer part of the skeletal

glucan seems to be composed mainly of beta-1,3 and beta-1,6 glucoside linkages and has a close structural similarity to lentinan, a water-soluble beta-glucan from L. edodes. The middle part of the skeletal glucan appears to be composed mainly of beta-1,6 glucoside linkages. The innermost part of the skeletal glucan is a highly branched glucan with beta-1,6 and beta-1,3 linkages. Probably, it is associated with chitin and a small amount of amino acid polymer.

PMID: 7198117, UI: 82075734

G Batteriol Virol Immunol 1981 Jul;**74(7-12):**267-274

[Basidiomycetes in relation to antibiosis. II. Antibiotic activity of mycelia and culture liquids].

[Article in Italian]

Bianco Coletto MA

The author relates the results of the antibiotic activity of mycelia and culture liquids of 34 Basidiomycetes, tested against Escherichia coli, Staphylococcus aureus, Bacillus subtilis and Candida albicans. The mycelium disc test and the cylinder plate method were used, employing for the latter culture liquids at different ages. The most active against the three bacterial species were Psathyra spadiceo-grisea, Fistulina hepatica and Fomes pinicola; against S. aureus and B. subtilis, Lentinus edodes and Psilocybe coprophila; Coprinus phlyctidosporus, Lepista amara, Pholiota nameko, Pleurotus ostreatus 774 and 779, Schizophyllum commune, Stropharia melanosperma, Boletus felleus, Polyporus Schweinitzii and Trametes pini 786 are active only against B. subtilis. Psathyra spadiceo-grisea and Lentinus edodes showed activity against Candida albicans as well. Comparison is made of activity results of the strains employed with the currently accepted data in the literature for the same species.

PMID: 6813176, UI: 83028291

Arch Virol 1981;**68(3-4):**297-301

Antitumor effect of virus-like particles from Lentinus edodes (Shiitake) on Ehrlich ascites carcinoma in mice.

Takehara M, Mori K, Kuida K, Hanawa MA

PMID: 7271461, UI: 81281021

Zentralbl Bakteriol [Naturwiss] 1980;**135(4):**367-373

[Studies of the nitrogen and carbon content of culture media and of mushrooms, as well as the free amino acid composition of myecelia and fruiting bodies of Lentinus edodes].

[Article in German]

Kleinmann-Klar D

The level contents of nitrogen and carbon in the analysed nature substances may be considered the reason for the good growth of Lentinus edodes on this culture medium (sugar-beet molasses and sawdust). The separate parts of fruit-bodies are showing differences in contents of nitrogen, carbon and free amino-acids; the gills have the highest, the stalk the lowest concentration, that of the hats is taking a middle position. Young and old mycelia as well as the separate parts of fruit bodies are different out of total concentration also in composition of free amino acids. This may be a direction to development and transformations during the change from the vegetative to the reproductive phase.

PMID: 7191608, UI: 81035565

J Antibiot (Tokyo) 1979 Dec;**32(12):**1336-1345

Antiviral and interferon-inducing activities of a new peptidomannan, KS-2, extracted from culture mycelia of Lentinus edodes.

Suzuki F, Suzuki C, Shimomura E, Maeda H, Fujii T, Ishida N

Oral (PO) administration of KS-2 to adult DDI mice resulted in a peak serum interferon (IF) titer of 800 units (U)/ml 20 hours after administration with detectable levels persisting until 30 hours. After intraperitoneal (IP) injection, a peak serum IF titer of 1,600 U/ml was detected and it followed the same time course as that of oral administration. The IF induced by KS-2 shared certain physico-chemical properties with the standard preparation of immune IF and was not neutralized by an antiserum against type I IF. In mice infected intranasally (IN) with influenza A2 (H2N2) virus, KS-2 was found to possess significant protective activities. Efficacy of the agent was evidenced by an increase in survivor number, a prolongation of mean survival time, an inhibition of the development of lung consolidation induced by the viral infection and a decrease in virus titer in lung tissues. Both PO and IP administrations of KS-2 protected mice against infection and significant antiviral activities were achieved not only by prophylactic but also chemotherapeutic administration. The protective activities of KS-2 against influenza virus infection in mice are discussed in view of the immunopotentiation of the host animals.

PMID: 575532, UI: 80159543

Arch Virol 1979;**59(3):**269-274

Antiviral activity of virus-like particles from Lentinus edodes (Shiitake). Brief report.

Takehara M, Kuida K, Mori K

Interferon (IF) induction and antiviral activity by purified spherical (S) or filamentous (F) virus-like particles and S-derived RNA was studied. A single administration of S particles prior to virus challenge reduced significantly the mortality of mice infected with western equine encephalitis (WEE) virus.

PMID: 222241, UI: 79208624

J Antibiot (Tokyo) 1978 Nov;**31(11):**1079-1090

Isolation and characterization of a new antitumor polysaccharide, KS-2, extracted from culture mycelia of Lentinus edodes.

Fujii T, Maeda H, Suzuki F, Ishida N

A new antitumor and antiviral substance, KS-2, was prepared by ethanol precipitation of the hot water extract of culture mycelia of Lentinus edodes KSLE 007. It was further purified by ECTEOLA-cellulose and Sephadex G-100 column chromatography based on the interferon-inducing activity. Its homogeneity was revealed by CsCl density gradient centrifugation, electrophoresis on cellulose acetate and Sephadex G-100 and ECTEOLA-cellulose column chromatography. KS-2 is mainly composed of alpha-linked mannose and contains a small amount of peptide which consists of serine, threonine and alanine with residual amounts of the other amino acids. The estimated molecular weight of KS-2 is between 6.0 X 10(4) and 9.5 X 10(4). KS-2 suppressed the growth of EHRLICH as well as Sarcoma-180 tumors in mice when given either orally or intraperitoneally. It is also capable of inducing an interferon in mice when dosed orally or intraperitoneally. The acute LD50 of KS-2 was found to be extremely low, more than 12,500 mg/kg when administered orally to mice.

PMID: 569140, UI: 79067523

Virology 1977 Apr;**77(2):**880-883

Evidence for double-stranded RNA from polyhedral virus-like particles in Lentinus edodes (Berk.) Sing.

Ushiyama R, Nakai Y, Ikegami M

PMID: 558684, UI: 77176412

Gann 1976 Apr;**67(2):**191-195

Antitumor activity of degraded products of lentinan: its correlation with molecular weight.

Sasaki T, Takasuka N, Chihara G, Maeda YY

Lentinan, an antitumor polysaccharide from Lentinus edodes, was degraded to seven fractions by treatment with formic acid. The low molecular-weight fractions (I and II) showed no antitumor activity against sarcoma-180 solid-type tumor and the absorption maximum of Congo Red did not shift in their presence in 0.1M sodium hydroxide. The medium molecular-weight fraction III, which required the increase of doses (5 or 10 mg/kg) for inhibition of tumor growth, caused a little shift. On the other hand, the absorption maximum of Congo Red shifted largely by the presence of high molecular-weight fractions (IV approximately VII) which showed the inhibition ratio of over 95% in a dose of 1 mg/kg. Participation of molecular weight in the antitumor activity of polysaccharides which contain (1 leads to 3)-beta-D-glucan main chain was discussed.

PMID: 964551, UI: 77004110

Carbohydr Res 1976 Mar;**47(1):**99-104

Further study of the structure of lentinan, an anti-tumor polysaccharide from Lentinus edodes.

Sasaki T, Takasuka N

PMID: 178444, UI: 76186114

Agents Actions 1976 Feb;**6(1-3):**251-255

In vivo and in vitro macrophage activation by systemic adjuvants.

Bruley-Rosset M, Florentin I, Mathe G

Six systemic adjuvants of immunity were tested for their ability to induce macrophage activation. Four of them: living BCG, hydrosoluble extracts from BCG (HIU II) and from M.smegmatis (IPM), and lipopolysaccharide from E.coli (LPS), when administered to normal mice render macrophages non-specifically cytotoxic for tumor cells in vitro. The intensity of this phenomenon varied according to the route and time of adjuvant administration. In contrast, lentinan extracted from Lentinus edodes, and levamisole which is a synthetic chemical compound, depressed macrophage cytotoxic potential. BCG, IPM and LPS were shown to have a direct action on macrophages. After in vitro exposure to these agents, the cytotoxic potential of normal macrophages was greatly increased. Levamisole was unable to stimulate this macrophage function directly in vitro. On the other hand, such a macrophage activation has been induced in vitro when normal macrophages were cultivated in the presence of MIF coming from the supernatant of human lymphoblastoid cell lines.

PMID: 782207, UI: 76249898

Carbohydr Res 1975 May;**41:**211-218

On the water-soluble heterogalactan from the fruit bodies of Lentinus edodes.

Shida M, Haryu K, Matsuda K

The chemical structure of a heterogalactan isolated from the trichloracetic acid extract of the fruit bodies of Lentinus edodes is reported. It consists of a main chain of (1 yields 6)-linked alpha-D-galactopyranose residues, part of which are substituted in the 2-position either with single L-fucopyranose or D-mannopyranose residues. However, there is a possible alternative structure of a branched D-galactan in which most of the side-chains are terminated with L-fucose or D-mannose residues.

PMID: 1169121, UI: 75166379

Yakugaku Zasshi 1974 Jun;**94(6):**708-716

[Hypocholesterolemic activity of analogous compounds related to eritadenine, an active component of shiitake, Lentinus edodes Sing].

[Article in Japanese]

Tensho A, Shimizu I, Takenawa T, Kikuchi H, Rokujo T

PMID: 4472979, UI: 75029731

Nutr Sci Vitaminol (Tokyo) 1974;**20(4):**283-291

Characteristics of quinolinate phosphoribosyltransferase from the "Shiitake" mushroom (Lentinus edodes).

Taguchi H, Iwai K

PMID: 4373552, UI: 75061557

J Nutr Sci Vitaminol (Tokyo) 1974;**20(4):**269-281

Purification and properties of quinolinate phosphoribosyltransferase from the "Shiitake" mushroom (Lentinus edodes).

Taguchi H, Iwai K

PMID: 4373551, UI: 75061556

Cancer Res 1970 Nov;**30(11):**2776-2781

Fractionation and purification of the polysaccharides with marked antitumor activity, especially lentinan, from Lentinus edodes (Berk.) Sing. (an edible mushroom).

Chihara G, Hamuro J, Maeda Y, Arai Y, Fukuoka F

PMID: 5530561, UI: 71057757

Experientia 1969 Dec 15;**25(12):**1237-1238

Lentinacin: a new hypocholesterolemic substance in Lentinus edodes.

Chibata I, Okumura K, Takeyama S, Kotera K

PMID: 5391883, UI: 70087108

Nippon Rinsho 1969 Jun;**27(6):**1739-1743

[Study on the antineoplastic activity and analysis of active fractions of Polyporaceae, Lentinus edodes and other basidiomycetes].

[Article in Japanese]

Chihara G

PMID: 5816844, UI: 69264766

Nature 1969 May 17;**222(194):**687-688

Inhibition of mouse sarcoma 180 by polysaccharides from Lentinus edodes (Berk.) sing.

Chihara G, Maeda Y, Hamuro J, Sasaki T, Fukuoka F

PMID: 5768289, UI: 69181518

Nippon Naika Gakkai Zasshi 1969 May 10;**58(5):**405-409

[A case of bronchial asthma caused by spore of Lentinus edodes (Berk) Sing].

[Article in Japanese]

Shichijo K, Kondo T, Yamada M, Aoki M, Shimoyama K

PMID: 5818087, UI: 69293247

Arerugi 1969 Jan;**18(1):**81-85

[Case of bronchial asthma caused by the spores of Lentinus edodes (Berk) Sing].

[Article in Japanese]

Kondo T

PMID: 5813714, UI: 69167011

J Vitaminol (Kyoto) 1968 Sep 10;**14(3):**179-186

Studies on thiaminase of fungi. I. Thiaminase of Lentinus edodes (Berg.) Sing.

Ono T, Kawasaki M

PMID: 5707861, UI: 69103267

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4 citations found

Dev Biol Stand 1992;**77:**191-197

Recent progress in immunopharmacology and therapeutic effects of polysaccharides.

Chihara G

Lentinan, a (1----3)-beta-D-glucan with (1----6)-beta-D-glucopyranoside branches and its related polysaccharides have marked antitumour activity in allogeneic, syngeneic and autochthonous primary hosts, suppress chemical and viral oncogenesis, and prevent cancer recurrence or metastasis after surgery. Results of the clinical application of lentinan have proven prolongation of life-span of the patients with advanced and recurrent stomach, colorectal and breast cancer with only little toxic side effect. These polysaccharides also increase host resistance to various kinds of bacterial, viral and parasitic infections including AIDS. Lentinan appears to represent Host Defence Potentiators (HDPs), which can restore or augment the ability of responsiveness of the host to lympho-cytokines or other intrinsic bioactive factors through maturation, differentiation or proliferation of the important cells for host defence mechanisms. That is, HDPs might make the physiological constitution highly cancer and infection-resistant, which may be a concept in Oriental Medicine, the fundamental principle of which is to regulate homeostasis of the whole body and to bring the diseased person to his normal state. HDPs such as lentinan are the most appropriate drugs to prevent cancer recurrence, or the manifestation of AIDS symptoms in HIV carriers.

Publication Types:

- Clinical trial
- Randomized controlled trial
- Review
- Review, tutorial

PMID: 1426662, UI: 93050820

Rinsho Byori 1987 Sep; **Spec No 73:**92-101

[Correction of an immune disturbance of hemophilia with biological response modifiers--with special reference to the prevention of AIDS].

[Article in Japanese]

Matsuda J, Odashima S, Saito N, Hamauzu T, Ryu T, Gohchi K, Nagata M, Kawasugi K, Kinoshitha T, Kazama M, et al

PMID: 2449551, UI: 88141641

Fundam Clin Pharmacol 1987;**1(4):**283-296

Immunopharmacology of the immunotherapy of cancer, infection, and autoimmunity.

Hadden JW

The current status and future prospects of the immunotherapy of cancer, infection, and autoimmunity are reviewed briefly. Progress in treating the immunodeficiency of cancer with thymic hormones and drugs such as levamisole and lentinan has produced some degree of remission stabilization. Interferon, interleukin II, and LAK cells have inhibited active, progressive cancer. New approaches with monoclonal antibodies, immunotoxins, tumor necrosis factors, and so on are under rapid development. Future prospects focus on combined approaches yielding synergy. Treatment of infections in animals and man either prophylactically or therapeutically, with thymic hormones, interferons, and thymomimetic drugs such as levamisole and isoprinosine, demonstrate the efficacy of this approach. The use of these agents in conjunction with antimicrobial therapy in immunosuppressed hosts is warranted. In immunodeficiency associated with AIDS virus infection, interleukin II, thymic hormones, isoprinosine, and imuthiol have shown effect in partially restoring immune function, although with little clinical benefit. Their use with antiviral therapy is advocated. Finally, thymic hormones, isoprinosine, levamisole, and other sulfur-containing compounds have ameliorated murine and human autoimmune disease presumably through effects in improving cellular immune function. Continued development of this type of therapy is warranted. The continued progress of immunopharmacology as the science of immunotherapy portends the future successful development of many therapeutic approaches to these diseases.

PMID: 3436614, UI: 88138232

Nat Immun Cell Growth Regul 1987;**6(3):**116-128

Low natural killer syndrome: clinical and immunologic features.

Aoki T, Usuda Y, Miyakoshi H, Tamura K, Herberman RB

Twenty-three patients with low natural killer syndrome (LNKS), 7 males and 16 females, are reported here. These LNKS patients had an age range from 14 to 77 years, with a median of 36.5 years. LNKS is a newly proposed category of immune disorders, being characteristically diagnosed by lowered NK cell activity against K562 target cells as a definite laboratory abnormality, in association with general clinical symptoms of remittent fever and uncomfortable fatigue, persisting without explanation for more than 6 months. Other immune parameters, such as the DNA synthesis of peripheral blood mononuclear cells (PBMCs) in either the presence or absence of mitogens, the T4+/T8+ ratio and the number of Leu-11+ PBMCs, were usually within the normal range. Also, routine laboratory tests did not detect any abnormal findings. The LNKS patients responded well to the administration of an immunopotentiator called 'lentinan', a glucan extracted from the Japanese mushroom Lentinus edodes, despite no responses to conventional fever treatments such as the administration of antipyretics or antibiotics. All LNKS patients observed were universally free of antibodies in their sera to human T-lymphotropic retroviruses I and III, and lymphadenopathy was infrequent, indicating that the LNKS is a syndrome independent of acquired immunodeficiency syndrome (AIDS) or AIDS-related complex. Antibodies to other known viruses tested such as Epstein-Barr or measles virus, or cytomegalovirus were also negative or not significantly elevated in the sera before the initiation of lentinan administration. If a virus is the cause of LNKS, it may be a new, unknown virus or an unknown substrain of known viruses. None of the LNKS patients has died of this syndrome.

PMID: 2442602, UI: 87315101

129 citations found

Comp Immunol Microbiol Infect Dis 1997 Jun;**20(3):**261-270

Enhancement of the resistance of tilapia and grass carp to experimental Aeromonas hydrophila and Edwardsiella tarda infections by several polysaccharides.

Wang WS, Wang DH

Efficacies of eleven polysaccharides including Bar (glycan extracted from Barley), curdlan, Dex (dextran sulfate), inulin, krestin, laminaran, levan, PO (glycan extracted from Pleurotus ostreatus), scleroglucan, YG (yeast glucan), and zymosan, in the protection of tilapia, Tilapia aureus P., and grass carp, Ctenopharyngodon idellus, against bacterial infections in vivo were examined. Four glycans. namely, Bar, krestin, scleroglucan, and zymosan were observed to significantly increase the survival rates of tilapia (80, 60, 70, and 60%) and grass carp (60, 70, 90, and 60%) ($p < 0.05$) after injection with Aeromonas hydrophila. The above mentioned four glycans were also found to raise the survival rates of tilapia (70, 60, 80, and 50%) and grass carp (50, 50, 70, and 50%) ($p < 0.05$) significantly after infection with Edwardsiella tarda. Moreover, Bar, curdlan, krestin, scleroglucan, and zymosan were also found to significantly increase the number of NBT-positive staining cells ($p < 0.05$), which might indicate that to activate non-specific phagocytes in fish is one of the antibacterial mechanisms of polysaccharides.

PMID: 9280393, UI: 97424471

Appl Environ Microbiol 1997 Jun;**63(6):**2166-2174

Laccase isoenzymes of Pleurotus eryngii: characterization, catalytic properties, and participation in activation of molecular oxygen and Mn2+ oxidation.

Munoz C, Guillen F, Martinez AT, Martinez MJ

Two laccase isoenzymes produced by Pleurotus eryngii were purified to electrophoretic homogeneity (42- and 43-fold) with an overall yield of 56.3%. Laccases I and II from this fungus are monomeric glycoproteins with 7 and 1% carbohydrate content, molecular masses (by sodium dodecyl sulfate-polyacrylamide gel electrophoresis) of 65 and 61 kDa, and pIs of 4.1 and 4.2, respectively. The highest rate of 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonate) oxidation for laccase I was reached at 65 degrees C and pH 4, and that for laccase II was reached at 55 degrees C and pH 3.5. Both isoenzymes are stable at high pH, retaining 60 to 70% activity after 24 h from pH 8 to 12. Their amino acid compositions and N-terminal sequences were determined, the latter strongly differing from those of laccases of other basidiomycetes. Antibodies against laccase I reacted with laccase II, as well as with laccases from Pleurotus ostreatus, Pleurotus pulmonarius, and Pleurotus floridanus. Different hydroxy- and methoxy-substituted phenols and aromatic amines were oxidized by the two laccase isoenzymes from P. eryngii,

and the influence of the nature, number, and disposition of aromatic-ring substituents on kinetic constants is discussed. Although both isoenzymes presented similar substrate affinities, the maximum rates of reactions catalyzed by laccase I were higher than those of laccase II. In reactions with hydroquinones, semiquinones produced by laccase isoenzymes were in part converted into quinones via autoxidation. The superoxide anion radical produced in the latter reaction dismutated, producing hydrogen peroxide. In the presence of manganous ion, the superoxide union was reduced to hydrogen peroxide with the concomitant production of manganic ion. These results confirmed that laccase in the presence of hydroquinones can participate in the production of both reduced oxygen species and manganic ions.

PMID: 9172335, UI: 97316424

Anticancer Res 1997 May;**17(3C):**2105-2113

Role of apoptosis, proliferating cell nuclear antigen and p53 protein in chemically induced colon cancer in rats fed corncob fiber treated with the fungus Pleurotus ostreatus.

Zusman I, Reifen R, Livni O, Smirnoff P, Gurevich P, Sandler B, Nyska A, Gal R, Tendler Y, Madar Z

The role of apoptosis, proliferative cell nuclear antigen (PCNA) and p53 protein in the preventive effects of dietary fiber treated with the fungus Pleurotus ostreatus on rat-colon tumorigenesis was studied. Tumors were induced by five subcutaneous injections of 1,2-dimethylhydrazine (DMH), 20 mg/kg rat, once a week. Rats were fed a semi-synthetic fiberfree diet (control) or a high-fiber diet (15%) derived from corncob treated or non-treated with the fungus. The rats we sacrificed 24 weeks after the first carcinogenic injection. The fungus treated corn-cob significantly decreased tumor incidence (to 26%) as compared to 44% and 57% in the other dietary groups. The apoptotic index (AI) significantly decreased in malignant tissue as compared to non-tumorous tissue. PCNA and cytoplasmic content of p53 protein exhibited an increasing trend in malignant tissue as compared to benign tissue (at 15% and 18%, respectively). The fungus-treated corncob significantly increased the content of p53 in the cell cytoplasm (to 33%) and its serum levels in tumor-bearing rats (to 38%). The cellular concentration of PCNA decreased to 61% in tumors obtained from rats fed the fungus-treated corncob as compared to controls. A high positive correlation was found between tumor grade and p53 protein in the serum (r = 0.97) or in the cell cytoplasm (r = 0.77) and between tumor grade and PCNA (r = 0.81). An inverse relationship was found between tumor grade and AI (r = -0.63). We found that 15% of corncob fiber alone seems not to be enough to prevent chemically induced tumorigenesis. The corncob fiber (15%) treated with the fungus had a significant protective effect against DMH-induced rat colon cancer, even at 15% and this effect was accompanied by the activation of some cellular mechanisms such as apoptosis, PCNA and p53 protein activation. Incubation of corncob with the fungus Pleurotus os, increased the dietary fiber content up to 78%. Thus corncob inhibits colon cancer development, and, therefore, may considered of potential use to the public.

PMID: 9216672, UI: 97359756

Immunopharmacol Immunotoxicol 1997 May;**19(2):**175-183

Effects of Lentinus edodes, Grifola frondosa and Pleurotus ostreatus administration on cancer outbreak, and activities of macrophages and lymphocytes in mice treated with a carcinogen, N-butyl-N-butanolnitrosoamine.

Kurashige S, Akuzawa Y, Endo F

ICR mice were treated with a carcinogen, N-butyl-N'-butanolnitrosoamine BBN), every day for 8 consecutive weeks and the effects of oral administration of edible mushrooms on the induction of urinary bladder carcinoma and on the activities of macrophages and lymphocytes were studied. Bladder carcinoma were found in all 10 mice (100%) treated with BBN alone, while we observed carcinoma only in 9 of 17 mice (52.9%), in 7 of 15 mice (46.7%) and 13 of 20 mice (65.0%) treated with Lentinus edodes, Grifola frondosa and Pleurotus ostreatus, respectively. Chemotactic activity of macrophages was suppressed in mice treated with BBN alone but maintained almost the normal level in mice treated with BBN plus Lentinus, Grifola or Pleurotus. Lymphocytes collected from mice treated with BBN plus each mushroom showed almost normal blastogenic response against concanavalin A, although those from mice treated with BBN alone completely retarded their response. Cytotoxic activity of lymphocytes against Yac-1 cells was also maintained at a normal level in mice treated with BBN plus each mushroom. Whereas in mice treated with BBN alone significant depression of NK cell activity occurred. Significantly higher cytotoxic activity against P-815 cells was observed in lymphocytes from mice treated with BBN plus each mushroom than that in lymphocytes from normal mice or mice treated with BBN alone.

PMID: 9130004, UI: 97276251

Biochim Biophys Acta 1997 Apr 25;**1339(1):**23-30

Biochemical and molecular characterization of a manganese peroxidase isoenzyme from Pleurotus ostreatus.

Sarkar S, Martinez AT, Martinez MJ

In this study we purified and investigated the catalytic properties of a manganese peroxidase isoenzyme produced by the fungus Pleurotus ostreatus in liquid medium with peptone as nitrogen source. The isoenzyme was purified to homogeneity by chromatography on Bio-Rad Q-cartridge, Sephacryl S-200 and Mono-Q with activity yield of 59% and a purification factor of 36. The P. ostreatus MnP obtained had the same pI (3.75) and N-terminal sequence as MnP-1 of Pleurotus eryngii produced in the same medium (both exhibiting Mn-independent activities on phenolic and non-phenolic substrates). However, the N-terminal sequence of this P. ostreatus isoenzyme differed from a previous published sequence of MnP from this fungus. The results obtained show the importance of media composition in the production of different isoenzymes within the same fungal species. We have also demonstrated by Southern blots that the different isoenzymes are probably encoded by different genes, and that the MnP genes in both Pleurotus species are similar but different to those of Phanerochaete chrysosporium.

PMID: 9165096, UI: 97307754

Cas Lek Cesk 1997 Mar 19;**136(6):**186-190

[Regulation of cholesterol metabolism with dietary addition of oyster mushrooms (Pleurotus ostreatus) in rats with hypercholesterolemia].

[Article in Slovak]

Bobek P, Ozdin L, Kuniak L, Hromadova M

BACKGROUND: It is generally accepted that lowering of serum cholesterol levels reduces the risk of atherosclerosis. Identification and characterization of natural substances with hypocholesterolemic activity useful in dietetic prevention or treatment of hypercholesterolemia is still relevant in countries with persistent progression of hypercholesterolemia. Addition of oyster mushroom (Pleurotus ostreatus), an industrially produced wood-rotting fungus, to the diet effectively reduced cholesterol accumulation in serum and liver of rats fed a cholesterol diet.

The aim of a series of experiments was to explain the biochemical mechanism of this effect. METHODS AND RESULTS: Male Wistar rats fed a cholesterol (0.3%) diet shortly after weaning for a period of 8-10 weeks were used in the experiments. The addition of 5% of dried oyster mushroom to the diet had following effects: reduction of cholesterol level both in serum (5.12 +/- 0.55 vs. 3.44 +/- 0.16 mmol/l, $p < 0.02$) and liver (241 +/- 12 vs. 113 +/- 11 mmol/kg, $p < 0.001$); redistribution of cholesterol in favour of high-density lipoproteins; reduced production of very-low-density lipoproteins (135 +/- 7 vs. 96.5 +/- 5 mumol/h/kg, $p < 0.001$); reduced cholesterol absorption (61.2 +/- 2 vs. 53 +/- 2%, $p < 0.02$) and reduced HMG-CoA activity in liver (137 +/- 16 vs. 86 +/- 9 pmol/min/mg proteins, $p < 0.02$). Simultaneously, an increase in 7 alfa-hydroxylase activity in liver (17 +/- 1 vs. 22 +/- 1 pmol/min/mg proteins. $p < 0.02$) and bile acid excretion (7 +/- 0.9 vs. 11 +/- 0.5 mg/day/rat, $p < 0.02$) was observed. (Values shown are means +/- SEM.) CONCLUSIONS: Biochemical mechanism of hypocholesterolemic effect of oyster mushroom on cholesterol-fed rats includes reduced production of cholesterol-rich very-low-density and low-density lipoproteins which principally determine cholesterol levels in serum. This effect is related to decreased absorption and biosynthesis of cholesterol together with increase in cholesterol catabolism and excretion of degradation products-bile acids.

PMID: 9221192, UI: 97316561

Appl Biochem Biotechnol 1997 Feb;**62(2-3):**131-149

Mechanism and potential applications of bio-ligninolytic systems in a CELSS.

Sarikaya A, Ladisch MR

A large amount of inedible plant material, generated as a result of plant growth in a Controlled Ecological Life Support System (CELSS), should be pretreated and converted into forms that can be recycled on earth as well as in space. The main portion of the inedible biomass is lignocellulosic material. Enzymatic hydrolysis of this cellulose would provide sugars for many other uses by recycling carbon, hydrogen, oxygen, and nitrogen through formation of carbon dioxide, heat, and sugars, which are potential foodstuffs. To obtain monosaccharides from cellulose, the protective effect of lignin should be removed. White-rot fungi degrade lignin more extensively and rapidly than other microorganisms. Pleurotus ostreatus degrades lignin effectively, and produces edible and flavorful mushrooms that increase the quality and nutritional value of the diet. This mushroom is also capable of metabolizing hemicellulose, thereby providing a food use of this pentose containing polysaccharide. This study presents the current knowledge of physiology and biochemistry of primary and secondary metabolisms of basidiomycetes, and degradation mechanism of lignin. A better understanding of the ligninolytic activity of white-rot fungi will impact the CELSS Program by providing insights on how edible fungi might be used to recycle the inedible portions of the crops.

Publication Types:

- Review
- Review, tutorial

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Folia Microbiol (Praha) 1997;**42(2):**136-140

Removal of PCBs by various white rot fungi in liquid cultures.

Novotny c, Vyas BR, Erbanova P, Kubatova A, Sasek V

The ability of Phanerochaete chrysosporium, Trametes versicolor, Coriolopsis polyzona, and Pleurotus ostreatus growing in a mitogen-limited mineral medium (NMM) to degrade PCBs in a commercial, Delor 106 mixture at a concentration of 0.9 ppm was compared. The respective amount of PCBs removed from the fungal cultures within 3 weeks were 25, 50, 41 and 0%. The capacities of the individual fungal species to remove PCBs correlated to some extent with their capabilities of decolorization of NMM agar containing both Poly R-478 or Remazol Brilliant Blue R dyes. Enzyme estimations indicated that both high and relatively stable activities of Mn-dependent peroxidase, Mn-independent peroxidase, lignin peroxidase, and laccase characterized efficient PCB degraders.

PMID: 9340310, UI: 97476968

Curr Genet 1996 Dec;**30(6):**549-552

Mitochondrial DNA inheritance in sexual crosses of Pleurotus ostreatus.

Matsumoto T, Fukumasa-Nakai Y

The inheritance of mitochondrial DNA (mtDNA) in sexual crosses was investigated to expand our understanding of the large genetic divergence in mtDNAs among natural populations of the higher basidiomycete Pleurotus ostreatus. Reciprocal crosses were made between compatible monokaryons with distinguishable mtDNA restriction fragment length polymorphisms (PFLPs). Almost all of the dikaryons produced by these crosses had mtDNA genotypes from one of the parental monokaryons. However, for dikaryons isolated from the junction-zone of crossed monokaryons, recombinant mitochondrial genomes commonly appeared. These results showed that P. ostreatus mtDNA can be inherited biparentally, via mtDNA recombination, as well as uniparentally. Further, it was suggested that mtDNA recombination may be an important source of variation in mitochondrial genomes among natural populations of P. ostreatus.

PMID: 8939817, UI: 97094350

Z Ernahrungswiss 1996 Sep;**35(3):**249-252

Oyster mushroom (Pleurotus ostreatus) reduces the production and secretion of very low density lipoproteins in hypercholesterolemic rats.

Bobek P, Ozdin L

Oyster mushroom (Pleurotus ostreatus) reduced the production and secretion of nascent very low density lipoproteins in hypercholesterolemic rats. In male Wistar rats (initial body weight about 70 g) fed a semisynthetic diet with 0.3% of cholesterol, the addition of 5% of powdered oyster mushroom (Pleurotus ostreatus) to the diet reduced after 8 weeks the level of serum cholesterol (by 36%) and accumulation of cholesterol and triglycerides in liver (by 51 and 32%, respectively). The decreased levels of serum cholesterol were caused to the same extent by reduction of cholesterol content in very low density lipoproteins (VLDL) and in low density lipoproteins (LDL) (by 53 and 47%, respectively). Biosynthesis of all structural lipids of VLDL (phospholipids, cholesterol, triglycerides) in liver and incorporation of de novo synthesized lipids into secreted nascent VLDL (measured by simultaneous application of Na-acetate-1-14 C and Triton WR 1339 which inhibits peripheral lipolysis) was reduced by application of diet with oyster mushroom.

PMID: 8896287, UI: 97051611

Curr Microbiol 1996 Sep;**33(3):**181-186

Purification and Characterization of Glutamine Synthetase from the Basidiomycete Pleurotus ostreatus.

Zofall M, Schánel L, Turánek J, Op den Camp HJM, Mikes V

[Record supplied by publisher]

The purification and some properties of glutamine synthetase (GS) from the mycelium of the basidiomycete Pleurotus ostreatus are described. The enzyme was purified to apparent homogeneity with ion exchange chromatography and a Dyematrex Green A column as the major purification steps. The GS has a molecular weight of 470 kDa and is composed of eight subunits with a molecular weight of 58 kDa. A tetrameric form of the enzyme may also be active. The apparent Km values for the biosynthetic reaction varied in different mycelial extracts from 2.5 to 3.5 mM and from 0.02 to 0.06 for glutamate and ammonium respectively. In the transferase reaction, Km values of 48 mM and 6.2 mM were found for L-glutamine and hydroxylamine, respectively. From the divalent cations tested, Mn2+ showed the strongest stimulatory effect both on the transferase and the biosynthetic reaction. ADP was the only nucleotide having an activating effect on the transferase reaction. The biosynthetic reaction was strongly inhibited by AMP and the transferase reaction by carbamoylphosphate. L-Alanine and glycine inhibited both reactions.

PMID: 8672095

Nahrung 1996 Aug;**40(4):**222-224

Effect of oyster mushroom (Pleurotus Ostreatus) and its ethanolic extract in diet on absorption and turnover of cholesterol in hypercholesterolemic rat.

Bobek P, Ozdin L, Kuniak L

The effect of the diet containing 5% of powdered oyster mushroom (Pleurotus ostreatus) or an equivalent amount of mushroom ethanolic extract on cholesterol content in serum and liver, on its distribution in lipoproteins, absorption and turnover was studied in male Wistar rats (initial body weight about 70 g) fed a diet with 0.3% cholesterol. 12 weeks of feeding with whole oyster mushroom or mushroom extract reduced cholesterol level in serum by 52 and 33%, respectively. However, cholesterol content in liver was reduced only by whole oyster mushroom (by 20%). Diminished serum cholesterol level was mediated in 60% by reduction of cholesterol in very-low-density lipoproteins. Both whole oyster mushroom and mushroom extract increased the concentration of cholesterol in high-density lipoproteins. Consuming whole oyster mushroom decreased cholesterol absorption (estimated by dual-isotope plasma ratio method) by nearly 16% while no significant effect of mushroom extract could be demonstrated. Feeding the diet containing whole oyster mushroom or its extract reduced the half-times of decay curve of cholesterol-4-14C by 29 and 35%, respectively and reciprocally increased the fractional catabolic rate of plasma cholesterol.

PMID: 8810086, UI: 96405961

Appl Environ Microbiol 1996 Jul;**62(7):**2547-2553

Metabolism of phenanthrene by the white rot fungus Pleurotus ostreatus.

Bezalel L, Hadar Y, Fu PP, Freeman JP, Cerniglia CE

The white rot fungus Pleurotus ostreatus, grown for 11 days in basidiomycetes rich medium containing [14C] phenanthrene, metabolized 94% of the phenanthrene added. Of the total radioactivity, 3% was oxidized to CO2. Approximately 52% of phenanthrene was metabolized to trans-9,10-dihydroxy-9,10-dihydrophenanthrene (phenanthrene trans-9,10-dihydrodiol) (28%), 2,2'-diphenic acid (17%), and unidentified metabolites (7%). Nonextractable metabolites accounted for 35% of the total radioactivity. The metabolites were extracted with ethyl acetate, separated by reversed-phase high-performance liquid chromatography, and characterized by 1H nuclear magnetic resonance, mass spectrometry, and UV spectroscopy analyses. 18O2-labeling experiments indicated that one atom of oxygen was incorporated into the phenanthrene trans-9,10-dihydrodiol. Circular dichroism spectra of the phenanthrene trans-9,10-dihydrodiol indicated that the absolute configuration of the predominant enantiomer was 9R,10R, which is different from that of the principal enantiomer produced by Phanerochaete chrysosporium. Significantly less phenanthrene trans-9,10-dihydrodiol was observed in incubations with the cytochrome P-450 inhibitor SKF 525-A (77% decrease), 1-aminobenzotriazole (83% decrease), or fluoxetine (63% decrease). These experiments with cytochrome P-450 inhibitors and 18O2 labeling and the formation of phenanthrene trans-9R,10R-dihydrodiol as the predominant metabolite suggest that P. ostreatus initially oxidizes phenanthrene stereoselectively by a cytochrome P-450 monoxygenase and that this is followed by epoxide hydrolase-catalyzed hydration reactions.

PMID: 8779594, UI: 96271704

Zentralbl Veterinarmed [B] 1996 May;**43(3):**129-135

The immunomodulatory effect of the soluble fungal glucan (Pleurotus ostreatus) on delayed hypersensitivity and phagocytic ability of blood leucocytes in mice.

Paulik S, Svrcek, Mojzisova J, Durove A, Benisek Z, Huska M

The effect of fungal and yeast glucan on different immune functions in mice was examined and compared. The simultaneous administration of glucan and a sensitizing dose of DNFB on the different sites significantly stimulated delayed-type hypersensitivity (DTH) response only when using fungal glucan. Both glucans tested, when administered before sensitization, significantly increased DTH response, but with a significantly higher level at the beginning of the investigation (on day 7) when using fungal glucan. The increase in phagocytic activity by the blood leucocytes started in the 1st week after fungal-glucan treatment, and in the 2nd week after yeast-glucan treatment, and took longer after administration of fungal glucan. The values of the phagocytic-activity index were significantly influenced only after fungal-glucan injection. The results of the study indicate that fungal glucan isolated from Pleurotus ostreatus could be a prospective immunomodulating substance.

PMID: 8928572, UI: 96251012

Eur J Biochem 1996 Apr 15;**237(2):**424-432

Purification and catalytic properties of two manganese peroxidase isoenzymes from Pleurotus eryngii.

Martinez MJ, Ruiz-Duenas FJ, Guillen F, Martinez AT

The ligninolytic basidiomycetes Pleurotus eryngii, Pleurotus ostreatus, Pleurotus pulmonarius and Pleurotus sajor-caju did not exhibit detectable levels of manganese peroxidase (MP) when grown in liquid media with ammonium tartrate as N source. However, after examination of cells grown on different organic N-based media, high MP activity was obtained in peptone medium, up to nearly 3 U/ml in cultures of P. eryngii. Moreover, Mn2+

supplementation was not used to produce MP, since all Mn2+ concentrations assayed (1-4000 microM) inhibited production of this enzyme in liquid medium. Two MP isoenzymes were purified to homogeneity from shaken or stationary cultures of P. eryngii grown in peptone medium. The purification process (which included chromatography on Biorad Q-cartridge, Sephacryl S-200 and Mono-Q) attained 56% activity yield with a purification factor of 25. The isoenzymes differed in pI (3.75 and 3.65), N-terminal sequence and some catalytic properties. They were in some aspects (e.g, molecular mass of 43 kDa) similar to Phanerochaete chrysosporium MP but exhibited some distinct characteristics, including Mn(2+)-independent peroxidase activities against 2,6-dimethoxyphenol and veratryl alcohol, and higher resistance to H2O2. Recent studies have shown that MP are ubiquitous enzymes in ligninolytic fungi, but the results obtained suggest that differences in catalytic properties probably exist between different Mn(2+)-oxidizing peroxidases produced by these fungi.

PMID: 8647081, UI: 96215438

Biosci Biotechnol Biochem 1996 Mar;**60(3):**472-475

The integrative transformation of Pleurotus ostreatus using bialaphos resistance as a dominant selectable marker.

Yanai K, Yonekura K, Usami H, Hirayama M, Kajiwara S, Yamazaki T, Shishido K, Adachi T

A plasmid pLC-bar containing the bialaphos resistance gene derived from Streptomyces hygroscopicus between the Lentinus edodes ras gene promoter and priA gene terminator was constructed. When protoplasts of Pleurotus ostreatus were mixed with the plasmid DNA in the presence of polyethylene glycol and CaCl2, bialaphos-resistant colonies were obtained. This indicated that transformation was successful. Southern blot analysis of total DNAs from transformants showed that the introduced plasmid DNA was integrated into the host chromosome and partly rearranged. A plasmid, pLC-GUS, containing the Escherichia coli beta-glucuronidase (GUS) gene under the control of the L. edodes ras gene promoter and priA gene terminator was constructed and introduced into protoplasts of P. ostreatus with pLC-bar by co-transformation. Two of 5 transformants obtained as bialaphos-resistant colonies showed two to twenty times higher specific activity of GUS than the recipient. Southern blot analysis of total DNAs from transformants indicated the presence of the GUS gene only in the two transformants. These results indicated that co-transformation of P. ostreatus was successful, and that the GUS gene was expressed in P. ostreatus. This transformation system will enable us to breed commercial strains of P. ostreatus at the molecular level.

PMID: 8901106, UI: 97056767

Biochem J 1996 Mar 1;**314(Pt 2):**421-426

Mode of action and active site of an extracellular peroxidase from Pleurotus ostreatus.

Han YH, Shin KS, Youn HD, Hah YC, Kang SO

The properties of the haem environment of an extracellular peroxidase from Pleurotus ostreatus were studied by electronic absorption spectroscopy. A high-spin ferric form was predominant in the native enzyme and a high-spin ferrous form in the reduced enzyme. Cyanide was readily bound to the haem iron in the native form, thereby changing the enzyme to a low-spin cyano adduct. The electronic absorption spectra of the enzyme were similar to those of lignin peroxidase from Phanerochaete chrysosporium. Compound III of the enzyme was formed after the addition of an excess of H2O2 to the native enzyme, and thereafter spontaneously reverted to the native form. The enzyme oxidized 1-(3,5-dimethoxy-4-hydroxyphenyl)-2-(2-methoxyphenoxy)-1,3-dihydroxyp ropane in the presence of H2O2 to produce 1-(3,5-dimethoxy-4-hydroxyphenyl)-2-(2-methoxyphenoxy)-1-oxo-3-hydroxypr

opane , 2,6-dimethoxyhydroquinone, 2-(2-methoxyphenoxy)-3-hydroxypropanal, 2-(2-methoxyphenoxy)-3-hydroxypropanoic acid, 2,6-dimethoxy-1,4-benzoquinone and guaiacol. A similar oxidation pattern was demonstrated with a one-electron oxidant, ammonium cerium(IV)nitrate. Free radicals were detected as intermediates of the enzyme-mediated oxidation of 1-(3,5-dimethoxy-5-hydroxyphenyl)-2-(2-methoxyphenoxy)-1,3-dihydroxyp ropane and acetosyringone. These results can be explained by the mechanisms involving an initial one-electron oxidation of the lignin substructure. This radical may undergo C alpha-C beta cleavage, C alpha-oxidation and alkyl-phenyl cleavage.

PMID: 8670051, UI: 96239096

J Biol Chem 1996 Feb 9;**271(6):**3105-3111

A heme-containing ascorbate oxidase from Pleurotus ostreatus.

Kim YR, Yu SW, Lee SR, Hwang YY, Kang SO

A novel type of ascorbate oxidase was purified 420-fold from the cytosolic fraction of the mycelia of Pleurotus ostreatus with an overall yield of 13%. The molecular mass of the native enzyme determined by high performance gel permeation chromatography was 94 kDa. Sodium dodecyl sulfate-polyacrylamide gel electrophoresis revealed that the enzyme consists of two subunits with a molecular mass of 46 kDa. The N-terminal amino acid sequence of the enzyme was Asp-Val-Lys-Thr-Leu-Gln-Glu-His-Leu-Gln-Leu-Ala-Leu-Met-Val-. The enzyme was optimally active at pH 5.2, monitored at 37 degrees C. The enzyme had affinity toward L-ascorbic acid, D-ascorbic acid, L-erythroascorbic acid, and D-erythroascorbic acid. Under optimal conditions, the Km value of the enzyme toward L-ascorbic acid was 0.48 mm. The absorption spectra of the native enzyme exhibited a Soret maximum at 418 nm in its oxidized form and at 426 nm in its reduced form, and alpha and beta bands at 558 and 527 nm only in its reduced form, respectively. On the basis of spectral changes after treatment with cyanide and carbon monoxide, the enzyme is a hemoprotein, quite similar to b-type cytochrome, and contains 2 mol of heme per molecule. The reaction catalyzed by the enzyme was L-ascorbic acid + O2 --> dehydro-L-ascorbic acid + H2O2.

PMID: 8621708, UI: 96216386

Eur J Biochem 1996 Feb 1;**235(3):**508-515

The gene, protein and glycan structures of laccase from Pleurotus ostreatus.

Giardina P, Aurilia V, Cannio R, Marzullo L, Amoresano A, Siciliano R, Pucci P, Sannia G

A member of the laccase multigene family in Pleurotus ostreatus has been cloned and sequenced. The gene structure has been determined by comparison with the corresponding cDNA, synthesized by reverse transcription/PCR amplification. The gene encode a laccase isoenzyme of 533 amino acids which has already been purified and characterized [Palmieri, G., Giardina, P., Marzullo, L., Desiderio, B., Nitti, G., Cannio, R. & Sannia, G.(1993) Appl. Microbiol. Biotechnol. 39, 632-636]. More than 92% of the protein sequence, including the N and C termini, has been verified by fast-atom-bombardment mass spectrometry, thus confirming the correspondence between the gene and its protein product. The protein was N-glycosylated Asn444. Glycan analysis showed the presence of only a high-mannose structure containing varying numbers of mannose residues. The presence of O-linked oligosaccharides as well as other post-translational modification could be ruled out by the mass analysis.

PMID: 8654395, UI: 96184523

Folia Microbiol (Praha) 1996;**41(1):**73-75

The effect of white-rot basidiomycetes on chemical composition and in vitro digestibility of wheat straw.

Jalc D, Nerud F, Zitnan R, Siroka P

Five white-rot basidiomycetes were evaluated for their potential to improve ruminal degradation of wheat straw. Polyorus brumalis, Lyophyllum ulmarium III, Trametes gibbosa, Pleurotus ostreatus, and a Pleurotus ostreatus mutant were incubated on wheat straw for 30 d at 28 degrees C. Detergent fiber, crude protein and in vitro dry matter digestibility (IVDMD) were determined. The results showed increasing crude protein and ash contents in fungus-treated straw. IVDMD values were increased in straws treated with P. ostreatus, P. ostreatus mutant and T. gibbosa only. Relative to untreated wheat straw the detergent fiber content-neutral detergent fiber (NDF), and acid detergent fiber (ADF) was reduced in fungus-treated straw and out of three fractions-hemicellulose, cellulose, and lignin, hemicellulose showed the largest proportionate loss whereas lignin the smallest one in all 5 samples of fungus treated straw.

PMID: 9090827, UI: 97246266

Chin J Biotechnol 1996;**12(1):**47-52

Transformation of Pleurotus sapidus protoplasts by electroporation.

Yan K, Zhu B, Cheng Y, Li Q, Zhao H

The total DNA of Pleurotus ostreatus was successfully transferred into the protoplasts of monokaryotic mycelia of Pleurotus sapidus by electroporation. The transformants were selected by their clamp connection of dikaryocyte, and the transformation frequency and transformation rate were 8.2 x 10(-5) and 3.6%, respectively. Analyzing the esterase isozyme, it was found that the transformants showed some isozyme bands of P. ostreatus and P. sapidus, and new non-parental bands. This proved that the recombination occurred between the DNAs of P. sapidus and P. ostreatus. The fruit bodies of the transformants showed morphological changes.

PMID: 8877114, UI: 97031188

Reprod Nutr Dev 1996;**36(3):**263-270

Effect of white-rot basidiomycetes-treated wheat straw on rumen fermentation in artificial rumen.

Jalc D, Nerud F, Erbanova P, Siroka P

This study evaluated three white-rot basidiomycetes for their potential to improve the ruminal degradation of wheat straw. Pleurotus ostreatus (PO), Pleurotus ostreatus-mutant (PO-M) and Trametes gibbosa (TG) were incubated on wheat straw for 30 days at 28 degrees C. Neutral detergent fiber (NDF), acid detergent fiber (ADF), crude protein and in vitro dry matter digestibility (IVDMD) were determined. The results demonstrated increasing crude protein and ash contents (%) in the fungi-treated straws. The IVDMD values were also increased. Compared to untreated wheat straw (UWS), the NDF and ADF contents were reduced in fungi-treated straw (TWS). Out of the three fractions-hemicellulose, cellulose and lignin-hemicellulose showed the largest proportionate loss and lignin the smallest in all three fungi-treated straws. TWS with Pleurotus ostreatus (TWS-PO), Pleurotus ostreatus-mutant

(TWS-PO-M) and Trametes gibbosa (TWS-TG) together with barley (80:20%) were used as the experimental diets in the artificial rumen. UWS with barley (80:20%) served as the control diet. The results revealed significantly higher IVDMD values, NDF, ADF and cellulose digestibilities (%) with the experimental diets. The production of propionic acid decreased, n-butyric, n-valeric and isovaleric acids (mmol/day-1) increased and the volatile fatty acid (VFA) production expressed in mol VFAs.kg-1 digested dry matter decreased in experimental diets. The total microbial production also decreased at fermentation in the experimental diets.

PMID: 8766731, UI: 96316302

Biosci Biotechnol Biochem 1995 Nov;**59(11):**2074-2080

Purification and characterization of intracellular proteinases in Pleurotus ostreatus fruiting bodies.

Dohmae N, Hayashi K, Miki K, Tsumuraya Y, Hashimoto Y

A serine proteinase (ProA, EC 3.4.22.9) and two metalloendopeptidases (ProB, EC 3.4.99.32 and ProC, 3.4.24.4), have been purified to homogeneity from the fruiting bodies of Pleurotus ostreatus. ProA is a serine proteinase with a mass of 30 kDa, which has amidolytic and esterolytic activities besides proteolysis and catalyzes preferential cleavage of the peptide bonds involving the carboxyl groups of hydrophobic amino acid residues in oxidized bovine insulin B chain. The N-terminal amino acid sequence was VTQTNAPWGLSRL. ProB is a zinc-enzyme with a mass of 18 kDa, which is devoid of lysine, and its N-terminal sequence was ATFVGCSATRQ. The enzyme is inactivated completely by EDTA and 1,10-phenanthroline, and Zn(2+)-depleted ProB can regain the activity with Zn2+, Co2+, or Mn2+. Specific cleavage of Pro29-Lys30 in oxidized bovine insulin B chain, preferential generation of lysylpeptides from proteins, and a high susceptibility of polylysine suggest that ProB splits specifically the peptide bonds involving the alpha-amino group of lysyl residues. ProC is a metalloendopeptidase of a mass of 42.5 kDa, and Zn2+ was the most effective divalent metal ion to activate the EDTA-inactivated enzyme.

PMID: 8541645, UI: 96100936

Appl Environ Microbiol 1995 Nov;**61(11):**3919-3927

Involvement of an extracellular H2O2-dependent ligninolytic activity of the white rot fungus Pleurotus ostreatus in the decolorization of Remazol brilliant blue R.

Vyas BR, Molitoris HP

During solid-state fermentation of wheat straw, a natural lignocellulosic substrate, the white rot fungus Pleurotus ostreatus produced an extracellular H2O2-requiring Remazol brilliant blue R (RBBR)-decolorizing enzymatic activity along with manganese peroxidase, manganese-independent peroxidase, and phenol oxidase activities. The presence of RBBR was not essential for the production of RBBR-decolorizing enzymatic activity by P. ostreatus, because this activity was also produced in the absence of RBBR. This RBBR-decolorizing enzymatic activity in crude enzyme preparations of 14- and 20-day-old cultures exhibited an apparent Km for RBBR of 31 and 52 microM, respectively. The RBBR-decolorizing enzyme activity was maximal in the pH range 3.5 to 4.0. This activity was independent of manganese, and veratryl alcohol had no influence on it. Manganese peroxidase of P. ostreatus did not decolorize RBBR. This H2O2-dependent RBBR-decolorizing enzymatic activity behaved like an oxygenase possessing a catalytic metal center, perhaps heme, because it was inhibited by Na2S2O5, NaCN, NaN3, and depletion of dissolved oxygen. Na2S2O5 brought an early end to the reaction without interfering with the initial reaction rate of RBBR oxygenase. The activity was also inhibited by cysteine. Concentrations of H2O2

higher than 154 microM were observed to be inhibitory as well. Decolorization of RBBR by P. ostreatus is an oxidative process.

PMID: 8526504, UI: 96064405

Biochim Biophys Acta 1995 Sep 6;**1251(2):**205-209

Structures of genomic and complementary DNAs coding for Pleurotus ostreatus manganese (II) peroxidase.

Asada Y, Watanabe A, Irie T, Nakayama T, Kuwahara M

To study the mechanism of regulation and structure/function relationship of the Pleurotus ostreatus manganese (II) peroxidase (MnP), we amplified the full-length genomic and complementary DNAs for the major isozyme of the MnP mainly by the cassette-primer PCR technique and then sequenced them. The cDNA contained an open reading frame of 1083 bp encoding for a polypeptide of 361 amino-acid residues, including the suggested signal peptide of 29 amino-acid residues with a prepro structure. The predicted amino-acid sequence of the protein shared several common characteristics with those of fungal lignin and manganese (II) peroxidases. We could find a suggested metal response element and two heat-shock element-like sequences in the 5'-flanking region of the structural gene. The structural gene contained 15 introns, many of which lie identical to those in lignin peroxidase genes rather than to those in the known MnP genes.

PMID: 7669812, UI: 95399442

J Nat Prod 1995 Sep;**58(9):**1426-1429

New antifungal bithienylacetylenes from Blumea obliqua.

Ahmad VU, Alam N

Two new bioactive bithienylacetylenes isolated from Blumea obliqua have been characterized as 5'-methyl-5-[4-(3-methyl-1-oxobutoxy)-1-butynyl]-2,2'- bithiophene [1] and 5'-hydroxymethyl-5-[butyl-3-en-1-yn]-2,2'-bithiophene isovaleroxy ester [2], respectively. Compounds 1 and 2 showed antifungal activity against Epidermophyton floccosum and Pleurotus ostreatus.

PMID: 7494149, UI: 96043286

Ceska Slov Farm 1995 Aug;**44(4):**190-195

[Phytotherapeutic aspects of diseases of the circulatory system. 4. Chitin and chitosan].

[Article in Czech]

Chobot V, Kremenak J, Opletal L

Chitin and chitosan are nitrogenous polysaccharides. The structure of the chitin molecule is similar to that of cellulose but it is composed of the units of 2-acetylamino-2-deoxy-D-glucopyranose bound (1 --> 4) by a glycosidic bond. In contrast to chitin, chitosan amino groups are not mostly acetylated. These polysaccharides occur

particularly in the fungal kingdom, in invertebrate animals, in some brown algae, and very negligibly in higher plants. Great attention has been paid to chitin and chitosan in recent years. Of great interest are their antihypercholesterolemic and antihyperlipidemic activities which have been experimentally demonstrated. In practice there already exist some medicinal preparations and food products with medicinal and preventive properties against some risk factors of atherosclerosis. Also the anticoagulative and anti-aggregative effects of sulfated derivatives of chitosan are not negligible. The research in this field is, however, at the initial stage. Both polysaccharides have been introduced into pharmaceutical technology where they can be employed as very good drug vehicles. Promising results have been achieved in experiments with antineoplastics (5-fluorouracil and methotrexate), with nonsteroidal antiphlogistics (ibuprofen) and others. It is considered very advantageous that chitin and chitosan possess low toxicity, allergize only a little, and exert moderate immunostimulating effects. Both polysaccharides are metabolized by lysosome. Chitin is obtained from the cuticles of sea animals which are waste products from food industry. The technologies of obtaining chitin from lower fungi (e.g. the genus Aspergillus) have been worked out. Chitosan is obtained by deacetylation of chitin. Chitin and chitosan are polysaccharides with ever-extending use. Increasing attention is paid to them also due to the fact that they are contained in a large extent in food fungi, e.g. Pleurotus ostreatus.

PMID: 7663872, UI: 95392940

Appl Environ Microbiol 1995 Aug;**61(8):**3057-3062

Effect of manganese on preferential degradation of lignin by Pleurotus ostreatus during solid-state fermentation.

Kerem Z, Hadar Y

Practical utilization of the polysaccharides in the lignocellulosic complex is limited because of the high lignin content of the complex. In this study we focused on the effect of Mn on lignin and cellulose biodegradation during solid-state fermentation by the edible mushroom Pleurotus ostreatus. Preferential degradation of lignin was enhanced by the addition of Mn(II) to cotton stalks at concentrations ranging from 30 to 620 micrograms of Mn per g. This effect was most apparent when we compared mineralization rates of [14C] lignin with mineralization rates of [14C] cellulose. Enhanced selectivity was also observed when we analyzed residual organic matter at the end of the fermentation period by using crude fiber analysis. The cellulose fraction in the original material was 1.8 times larger than the cellulose fraction of lignin. The cellulose/lignin ratio increased during 32 days of solid-state fermentation from 2.5 in the control to 3.3 following the addition of Mn to the medium. The in vitro digestibility value for fermented cotton stalks was 53% of the dry matter. Addition of 600 micrograms of Mn per g to the cotton stalks resulted in a digestibility value of 65.4%. Enhancement of preferential lignin degradation could be result of either increased activity of the ligninolytic enzymes or production of Mn (III), which might preferentially degrade aromatic structures in the lignocellulosic complex.

PMID: 7487038, UI: 96090162

Z Lebensm Unters Forsch 1995 Jul;**201(1):**17-19

[Mineral and amino acid contents of edible, cultivated shii-take mushrooms].

[Article in German]

Vetter J

World wide about 200,000 tons of shii-take mushrooms (Lentinus edodes) are produced per year. Different positive biological effects are known (anticarcinogenic, anticholesterol, immunostimulating effects), but the mineral contents and amino acid composition of caps and stipes are still little investigated. The concentrations of minerals are in general lower than those in the cultivated white mushroom (Agaricus bisporus) and in the oyster mushroom (Pleurotus ostreatus). The greatest differences are found in the concentrations of potassium, phosphorus, calcium, copper, strontium, manganese and zinc. The concentrations are higher in caps than in stipes. The total amino acid content is 15.24% in caps and 11.35% in stipes (dry matter) and thus in general half of the concentration of cultivated champignon. The amounts of Phe, Gly, His, Arg, Ile and Met are relative higher than in Agaricus fruit bodies.

PMID: 7571860, UI: 96035563

Experientia 1995 Jun 14;**51(6):**589-591

Oyster mushroom (Pleurotus ostreatus) reduces the activity of 3-hydroxy-3-methylglutaryl CoA reductase in rat liver microsomes.

Bobek P, Hromadova M, Ozdin L

The effect of dried oyster mushroom (Pleurotus ostreatus) on cholesterol (C) content in serum, in lipoproteins and in liver, and on the activity of 3-hydroxy-3-methylglutaryl CoA (HMG-CoA) reductase in liver microsomes, was studied in male rats (strain Wistar, initial body weight 75 g) fed on low-cholesterol (9 mg/100 g) and high-cholesterol (0.3%) diets. Addition of 5% oyster mushroom to both diets reduced significantly the C-content in serum (by 30%), in very-low- and low-density lipoproteins (in a 1:1 ratio to the decrease of total serum C) and in liver (by 50%), as well as the activity of HMG-CoA reductase (by more than 30%).

PMID: 7607302, UI: 95331369

Appl Environ Microbiol 1995 Jun;**61(6):**2408-2413

Cloning and sequencing of a laccase gene from the lignin-degrading basidiomycete Pleurotus ostreatus.

Giardina P, Cannio R, Martirani L, Marzullo L, Palmieri G, Sannia G

The gene (pox1) encoding a phenol oxidase from Pleurotus ostreatus, a lignin-degrading basidiomycete, was cloned and sequenced, and the corresponding pox1 cDNA was also synthesized and sequenced. The isolated gene consists of 2,592 bp, with the coding sequence being interrupted by 19 introns and flanked by an upstream region in which putative CAAT and TATA consensus sequences could be identified at positions -174 and -84, respectively. The isolation of a second cDNA (pox2 cDNA), showing 84% similarity, and of the corresponding truncated genomic clones demonstrated the existence of a multigene family coding for isoforms of laccase in P. ostreatus. PCR amplifications of specific regions on the DNA of isolated monokaryons proved that the two genes are not allelic forms. The POX1 amino acid sequence deduced was compared with those of other known laccases from different fungi.

PMID: 7793961, UI: 95314294

Pharmazie 1995 Jun;**50(6):**441-442

Antioxidative effect of oyster mushroom (Pleurotus ostreatus) in hypercholesterolemic rat.

Bobek P, Ozdin L, Kuniak L

PMID: 7651988, UI: 95380450

Curr Genet 1995 Apr;**27(5):**460-465

Presence of a P1 bacteriophage sequence in transforming plasmids of Pleurotus ostreatus.

Herzog RW, Singh NK, Schmidt C, Lemke PA

Replicative plasmids pP01 and pP02, recovered from Pleurotus ostreatus transformants, contain an insert of bacteriophage origin. These plasmids have been amplified by the polymerase chain reaction (PCR) and have been shown to represent a low-grade component in the initial preparation of the vector pAN7-1. The pP01 and pP02 plasmids share an insert (P01A) of virtual identity with a SmaI-BamHI genomic fragment of P 1 bacteriophage and retain remnants of a polylinker at the 5' end of this fragment. Such an insert undoubtedly represents an in vitro-generated event and did not arise, as suggested previously, by recombination of pAN7-1 with the P. ostreatus genome. The P. ostreatus transformants, however, do select for the minority pP0 plasmid, apparently recognizing the P01A insert as a heterologous or surrogate replicon.

PMID: 7586033, UI: 96059351

Exp Mycol 1995 Mar;**19(1):**1-6

Pleurotus fruiting bodies contain the inhibitor of 3-hydroxy-3-methylglutaryl-coenzyme A reductase-lovastatin.

Gunde-Cimerman N, Cimerman A

In the fruiting bodies of the fungus Pleurotus ostreatus, also called the oyster mushroom, we found a competitive inhibitor of 3-hydroxy-3-methylglutaryl-coenzyme A reductase-lovastatin. The appearance of the inhibitor during the development of fruiting bodies was followed and lovastatin determined in the vegetative mycelium, in the primordia, as well as in different parts of sporocarps of different sizes. Less lovastatin was found in stripes as compared to pili or in mature stages in the lamellae and basidiospores.

PMID: 7614366, UI: 95339197

J Biol Chem 1995 Feb 24;**270(8):**3823-3827

Veratryl alcohol oxidase from Pleurotus ostreatus participates in lignin biodegradation and prevents polymerization of laccase-oxidized substrates.

Marzullo L, Cannio R, Giardina P, Santini MT, Sannia G

Oxidative enzymes (laccases and peroxidases) isolated from the culture media of different fungi are involved in the basic mechanism of ligninolysis via radical intermediates. However, experiments aimed at reproducing natural biodegradation in vitro have been unsuccessful so far since the single biocatalysts alone are not able to solubilize lignins because of the simultaneous recondensation of these intermediates. FAD oxidases can prevent this side reaction in lignin depolymerization by reducing quinonoids and radical compounds. This study investigates the possible role of a laccase and a FAD-dependent aryl alcohol oxidase (veratryl alcohol oxidase, VAO) excreted by the basidiomycete Pleurotus ostreatus. In fact, we found that VAO is able to reduce synthetic quinones, laccase-generated quinonoids, and phenoxy radicals with concomitant oxidation of veratryl alcohol to veratryl aldehyde. This cooperative action of laccase and VAO also prevented the polymerization of phenolic compounds and reduced the molecular weight of soluble lignosulfonates to a significant extent.

PMID: 7876125, UI: 95181342

Microbiology 1995 Feb;**141(Pt 2):**393-398

Single electron transfer by an extracellular laccase from the white-rot fungus Pleurotus ostreatus.

Youn HD, Kim KJ, Maeng JS, Han YH, Jeong IB, Jeong G, Kang SO, Hah YC

Two different bands with laccase activity were obtained after nondenaturing PAGE of the culture filtrate of Pleurotus ostreatus. Immunoblot analysis revealed that antisera raised against laccase I were not reactive to laccase II. Laccase I, which exhibited faster mobility on nondenaturing polyacrylamide gel, was purified 42.9-fold with an overall yield of 10.8%. Gel filtration and SDS-PAGE revealed that laccase I is a single polypeptide with a molecular mass of approximately 64 kDa. Laccase I contained 12.5% carbohydrate by weight and 3.9 mol copper (mol protein)-1. The absorption spectrum of laccase I showed a type 1 signal at 605 nm and EPR spectra showed that the parameters of the type 1 and type 2 Cu signals were g parallel = 2.197 and A parallel = 0.009 cm-1, and g parallel = 2.263 and A parallel = 0.0176 cm-1, respectively. The data obtained from the pH profiles suggested that two ionization groups, whose pKa values were 5.60-5.70 and 6.70-6.85, may play an important role in the active site of laccase I as the ligand of copper metal. The optimal pH and temperature for the activity of laccase I were 6.0-6.5 and 30-35 degrees C, respectively. The enzyme had affinity for various lignin-related phenolic compounds: the Km values for ferulic acid and syringic acid were 48 and 89 microM, respectively. EPR spectroscopic study of the action of laccase I on 3,5-dimethoxy-5-hydroxyacetophenone indicated that this enzyme catalyses single electron transfer with the formation of the phenoxy radical as an intermediate.

PMID: 7704270, UI: 95219095

Arch Biochem Biophys 1995 Jan 10;**316(1):**498-506

The complete amino acid sequences of two serine proteinase inhibitors from the fruiting bodies of a basidiomycete, Pleurotus ostreatus.

Dohmae N, Takio K, Tsumuraya Y, Hashimoto Y

The complete amino acid sequences of two isomeric endogenous inhibitors, IA-1 and IA-2, both of which specifically inhibit an intracellular serine proteinase (proteinase A) purified from the fruiting bodies of a higher basidiomycete, Pleurotus ostreatus, were determined. Both inhibitors are acidic polypeptides with respective molecular masses of 8307 and 8244 Da, as determined by plasma desorption mass spectral analyses, and their

N-terminal serine residue is blocked by acetylation. The fragments generated from the inhibitors by proteolytic and chemical cleavages were subjected to amino acid composition, sequence, and mass spectral analyses. The sequence and molecular mass information for the peptides established that the inhibitors both consisted of 76 amino acid residues and differed from each other in that aspartic acid and glutamic acid residues at residues 12 and 15 of IA-1 were replaced by glycine and aspartic acid in IA-2, respectively. The molecular masses of IA-1 and IA-2 were calculated to be 8309 and 8237, based on the sequence data. The action of carboxypeptidase Y on IA-1 resulted in a complete loss of the inhibitory activity along with successive release of glutamine and threonine from the C-terminus. Cyanogen bromide cleavage of Met38-Pro39 and Met41-Lys42 in IA-1 and hydroxylamine degradation of IA-2 completely abolished their inhibitory activity. These results suggest that the whole molecules of both inhibitors are essential to their inhibitory activities. Their structural resemblance to propeptides of subtilisin family proteinases revealed their mechanism of action.

PMID: 7840656, UI: 95142669

Physiol Res 1995;**44(5):**287-291

Dietary oyster mushroom (Pleurotus ostreatus) accelerates plasma cholesterol turnover in hypercholesterolaemic rat.

Bobek P, Ozdin O, Mikus M

The effect of adding 5% powdered oyster mushroom (Pleurotus ostreatus) during 12 weeks on kinetic parameters of cholesterol metabolism was studied in male rats (Wistar, initial body weight 85 g) fed a semisynthetic diet containing 0.3% of cholesterol. The plasma cholesterol decay curve (examined for the final 29 days of the experiment after a single dose of cholesterol-4-14C) was evaluated by mathematical analysis using a two-pool model of plasma cholesterol metabolism. The oyster mushroom in the diet reduced the half-times of both exponentials resulting in lower calculated values (by 28%) of total entry of cholesterol into the body cholesterol pool (absorption+endogenous synthesis) and lower sizes of both pools (with slower and faster cholesterol exchange). The rate of cholesterol exchange between the pools was enhanced and the rate of total clearance of cholesterol from the system (metabolic turnover rate of cholesterol i.e. the rate of degradation and excretion of cholesterol from the organism) was enhanced by 50%. The oyster mushroom diet effectively prevented the progress of hypercholesterolaemia (decrease by 38%) and cholesterol accumulation in liver (decrease by 25%) that were induced by the cholesterol diet.

PMID: 8869262, UI: 97022902

Nahrung 1995;**39(1):**98-99

The effect of oyster mushroom (Pleurotus ostreatus), its ethanolic extract and extraction residues on cholesterol levels in serum, lipoproteins and liver of rat.

Bobek P, Ozdin L, Kuniak L

PMID: 7898579, UI: 95206390

FEMS Microbiol Lett 1995 Jan 1;**125(1):**51-56

Double-stranded RNA mycoviruses in mycelium of Pleurotus ostreatus.

van der Lende TR, Harmsen MC, Go SJ, Wessels JG

Mycelium of Pleurotus ostreatus var. florida with a decreased growth rate contained seven double-stranded RNA segments and isometrical virus particles with diameters of 24 and 30 nm. Mycelium with a normal growth rate lacked dsRNA. Protoclones from virus-containing mycelium contained one to seven of these dsRNA segments in varying concentrations. The exact correlation between slow growth and the presence of dsRNA molecules could not be established. Infection of virus-free protoplasts with PEG-precipitated virus particles resulted in mycelium that stably maintained the 2.4 kbp dsRNA. Published erratum appears in FEMS Microbiol Lett 1995 Mar 15;127(1-2):157

PMID: 7867920, UI: 95172372

Appl Biochem Biotechnol 1995 Jan;**50(1):**71-78

Solid-state fermentation of agricultural wastes into food through Pleurotus cultivation.

Jwanny EW, Rashad MM, Abdu HM

The technical feasibility of using agricultural wastes (mango and date industry wastes) as a substrate for the cultivation of Pleurotus ostreatus NRRL-0366 is evaluated. When comparing the biological efficiency of mushroom production, the highest yield of fruiting bodies was obtained using a mixture of date waste and rice straw at a ratio (1:1) (11.96%), followed by a mixture 3:1 (11.16%). The lowest one was the mixture 2:1 (9.19%). Fungus Pleurotus ostreatus NRRL-0366 can also be cultivated on mango waste supplemented with rice straw at a different ratio. The best one was the 1:1 mixture (10.18%), whereas the lowest was a mixture 3:1 (6.4%). Comparing the results obtained favored the use of date waste as a substrate for growing Pleurotus ostreatus NRRL-0366. Spawn was cultured on three different substrates as follows: Date waste alone (I); 1:1 (by wt) date waste and rice straw (II); 1:1:1 date waste, rice straw, and corncobs (III). Final dry weight and composition of the fruiting bodies are tabulated for the three sets of conditions. Date waste and rice straw mixture (II) is a good source of nonstarchy carbohydrate (67%) and protein (27.44%) containing amounts of essential amino acids, especially lysine and low RNA (3.81%). Elemental analysis were studied in the fruit bodies of the three media.

PMID: 7626144, UI: 95216939

Allergy 1994 Jul;**49(6):**460-465

Prevalence of basidiomycete allergy in the USA and Europe and its relationship to allergic respiratory symptoms.

Lehrer SB, Hughes JM, Altman LC, Bousquet J, Davies RJ, Gell L, Li J, Lopez M, Malling HJ, Mathison DA, et al

A total of 701 adults living in the USA or Western Europe who had symptoms of allergic respiratory disease were skin prick tested with extracts prepared from eight basidiomycetes species and four Fungi Imperfecti species. In these subjects, the presence of asthma, rhinitis, or both was determined by questionnaire. Overall, 178/701 (25.4%) of the participants reacted to at least one basidiomycete extract. There was no difference in the prevalence of reactivity detected in the USA and Europe ($P < 0.005$); however, the prevalence of reactors in individual centers

from both areas varied significantly. Psilocybe cubensis was the most potent allergen source in both the USA (12.3% reacted) and Europe (16.0%). Pleurotus ostreatus was second overall (10.6%) and in the USA (10.7%), and third in Europe (10.3%). Pisolithus tinctorius and Coprinus quadrifidus produced the least potent allergens, with only 5.4% of the population reacting. There was a significant relationship ($P < 0.005$) between basidiospore reactivity and the presence of atopy, asthma, and asthma and rhinitis. Basidiospore reactivity was not associated with the presence of rhinitis alone ($P = 0.312$). These results suggest that basidiomycetes are important sources of aeroallergens in geographically disparate regions and may be particularly important in patients with asthma.

PMID: 8074266, UI: 94354375

J Biochem (Tokyo) 1994 Jul;**116(1):**26-33

Purification and primary structure of a new guanylic acid specific ribonuclease from Pleurotus ostreatus.

Nomura H, Inokuchi N, Kobayashi H, Koyama T, Iwama M, Ohgi K, Irie M

A guanine nucleotide-specific RNase (RNase Po1) was isolated from caps of the fruit bodies of Pleurotus ostreatus. RNase Po1 is most active towards RNA at pH 8.0. The effect of heating on the molar ellipticity at 210 nm of RNase Po1 showed that RNase Po1 is more stable than RNase T1. The primary structure of RNase Po1 was determined to be < ETGVRSCNCAGRSFTGTDVTNAIRSARAGGSGNYPHVYNNFEGFSFSCTPTFFEFPVFRGSVYSGGSPG ADRVIYD- QSGRFCACLTHTGAPSTNGFVECRF. It consisted of 101 amino acid residues, with a molecular weight of 10,760. RNase Po1 has relatively higher sequence homology with RNase T1 family RNase. It contains 6 half cystine residues. The locations of four of them are superimposable on those of RNase U1 and RNase U2. The amino acid residues forming the active site of RNase T1 were well conserved in this RNase. Therefore, RNase Po1 is a unique member of the RNase T1 family in respect of the location of one disulfide bridge, and its stability.

PMID: 7798182, UI: 95096021

Schweiz Med Wochenschr 1994 May 28;**124(21):**885-892

[Current aspects of fungal spores allergy].

[Article in German]

Helbling A, Reese G, Horner WE, Lehrer SB

In industrialized countries the prevalence of allergic inhalant diseases is some 15-20%. More than 10% of these individuals are sensitized to fungal allergens. Many fungal spores are less than 10 microns in size, which permits penetration into the smaller airways of the lung. Bronchial provocation tests have demonstrated that fungal spores and spore extracts can cause both an early and a late phase reaction in sensitive subjects. Over 80 genera of fungi have been associated with symptoms of respiratory tract allergy. Ascomycetes, basidiomycetes and zygomycetes are the major fungal groups that contain genera known to induce and elicit allergic reactions. These groups contribute most of the spores found in air. Although ascomycetes include the greatest number of any fungal group, only a few species, such as Aspergillus fumigatus, Alternaria alternata and Cladosporium herbarum, have been investigated in a scientific manner. In recent years spores of basidiomycetes have been tested for allergenicity and some species have been determined to be allergenic, such as Calvatia cyathiformis, Ganoderma applanatum, Pleurotus ostreatus, or Psilocybe cubensis. Compared to pollen-related allergies, diagnosis of fungal allergy is often difficult. Provocative challenge with specific fungal antigens can provide a definitive diagnosis. To date, only three controlled immunotherapy trials with standardized extracts of A. alternata and C. herbarum have shown clinical

efficacy. In spite of these studies, immunotherapy with fungal antigens requires further investigations. Thus, the indication for immunotherapy with fungal extracts must be judged by an experienced allergist. Apart from pharmacological management, avoiding or minimizing exposure is the front-line measure.

Publication Types:

- Review
- Review, tutorial

PMID: 8016603, UI: 94287144

Z Ernahrungswiss 1994 Mar;**33(1):**44-50

Mechanism of hypocholesterolemic effect of oyster mushroom (Pleurotus ostreatus) in rats: reduction of cholesterol absorption and increase of plasma cholesterol removal.

Bobek P, Ozdin L, Kuniak L

The content of cholesterol in the serum and liver of male Wistar rats fed, for the period of 8 weeks shortly after weaning, a diet containing 0.3% of cholesterol was reduced by 33 and 27% by the addition of 5% of dried oyster mushroom powder. Although the level of serum triacylglycerols was not affected by oyster mushroom, their content in liver of rats on mushroom diet was reduced by 41%. Very-low-density lipoproteins and low-density lipoproteins participated by 55 and 38%, respectively, in the total reduction of serum cholesterol. Cholesterol content in high-density lipoproteins was not significantly affected by oyster mushroom. Cholesterol absorption as determined by dual-isotope plasma ratio method was significantly reduced by 14% with oyster mushroom diet. Similarly, this diet increased by 42% the fractional catabolic rate of cholesterol determined by the analysis of decay curve of [4-14C]cholesterol.

PMID: 8197787, UI: 94256128

Physiol Res 1994;**43(3):**205-206

The mushroom Pleurotus ostreatus accelerates plasma very-low-density lipoprotein clearance in hypercholesterolemic rat.

Bobek P, Ozdin L

The administration of a diet containing 5% of dried oyster mushroom to male Wistar rats fed a cholesterol diet (0.3%) shortly after weaning for 8 weeks reduced cholesterol levels in the serum and liver by 27 and 33%, respectively and increased the fractional turnover rate of 125I-very-low-density lipoproteins (VLDL) by more than 30%.

PMID: 7993890, UI: 95086055

Z Lebensm Unters Forsch 1993 Nov;**197(5):**427-428

[Crude, digestible and indigestible fruit body proteins in oyster

mushroom Pleurotus ostreatus].

[Article in German]

Vetter J, Rimoczi I

Different kinds of protein (crude, digestible, non-digestible) were analysed in caps and stipe of Pleurotus ostreatus (oyster mushroom) in four phases of development. The phases examined were: a (cap diameter < 5 cm); B (diameter 5-8 cm); C (diameter, 8-10 cm) and D (diameter > 10 cm). The Pleurotus variety analysed (the cap and the stipe) has a relative high crude protein content, the main part of which is digestible (average, 92%). During the four stages of fruit body ripening, stage B was the best, with the highest crude and digestible protein concentrations. In stage D the highest non-digestible protein content was measured in the cap and stipe. These data can be used for optimal harvesting of fruit bodies of cultivated P. ostreatus.

PMID: 8273423, UI: 94098937

Cesk Farm 1993 Aug;**42(4):**160-166

[Phytotherapeutic aspects of diseases of the circulatory system. 2. The oyster mushroom and its potential use].

[Article in Czech]

Opletal L

The oyster fungus (Pleurotus ostreatus (Jacq. ex Fr.) Kumm., Pleurotaceae) is a wood-worming fungus with a significant use in the food industry. Out of the products of the primary and special metabolisms, which were found in fruit bodies in the 1970s, it is possible to mention mainly lipids, sterols, lipophilic vitamins, vitamins of the B group, mono-, oligo- and polysaccharides, amino acids, peptides, some enzymes and derivatives of aliphatic hydrocarbons as fragrant substances. Some of these substances exert antiviral, antineoplastic and hypocholesterolaemic activities. In the case of the hypocholesterolaemic effect, not all substances that take part in it have been isolated and identified yet. The fruit bodies of the oyster fungus became a basis for some dietetic preparations in the Czech Republic and Slovakia, e.g. HLIVETA Eritaden and PLEUROS 600. They are usable for the prevention and adjuvant treatment of hypercholesterolaemia. Besides this, the oyster fungus is a source of other substances that can be used in other fields of prevention or treatment.

PMID: 8402971, UI: 94006643

Eur J Biochem 1993 Aug 1;**215(3):**747-752

Purification and characterisation of D-glucose oxidase from white-rot fungus Pleurotus ostreatus.

Shin KS, Youn HD, Han YH, Kang SO, Hah YC

D-Glucose oxidase was purified 27.5-fold to apparent homogeneity with an overall yield of 23.8%, from Pleurotus ostreatus, through a purification procedure of ammonium sulphate precipitation, gel-permeation, anion-exchange and hydrophobic-interaction chromatography. The molecular mass determined by gel filtration was found to be 290 kDa. SDS/PAGE revealed that the enzyme consists of four subunits with a molecular mass of 70 kDa. The

absorption spectra of the enzyme exhibit maxima at 280, 360 and 460 nm. The enzyme shows a fluorescence spectrum with an excitation maximum at 470 nm and an emission maximum at 530 nm. These results indicate that the prosthetic group of the enzyme is flavin and that the enzyme contains 4 mol flavin/mol enzyme. The enzyme is optimally active at 50 degrees C and at pH 5.5-6.0. It exhibits broad affinity for various sugars and specificity for D-glucose with Km value of 1.34 mM. 2,6-Dichloroindophenol, Wurster's blue, and 4-benzoquinone can function as electron acceptors but phenazine methosulphate cannot function as an electron acceptor. The enzyme is inhibited completely by mercuric chloride and partially by silver sulphate, sodium azide 8-hydroxyquinoline.

PMID: 8354282, UI: 93358899

J Allergy Clin Immunol 1993 Aug;**92(2):**306-312

Basidiospore allergen release: elution from intact spores.

Horner WE, Levetin E, Lehrer SB

BACKGROUND: We sought to test the hypothesis that allergens are readily released by intact basidiospores in vitro and that different species release allergens in different patterns that are related to spore wall structure. METHODS: To assess basidiospore allergen releasability, basidiospore allergens were extracted from disrupted spores and eluted from intact spores, and the allergenic potency of the extracts and eluates was compared in Calvatia cyathiformis, Psilocybe cubensis, Lentinus edodes, and Pleurotus ostreatus. RESULTS: There was a significant species difference; on the basis of dry weight, the yield of extract and eluates from P1. ostreatus greatly exceeded the yield from C. cyathiformis extract and eluates. As measured by RAST inhibition, the allergenic potency of P1. ostreatus and L. edodes spore eluates reached the potency of disrupted spore extract in less than 4 hours. Allergen potency of Ps. cubensis and C. cyathiformis eluate approached the potency of disrupted spore extract only after 8 and 24 hours. Allergen staining intensity in sodium dodecyl sulfate polyacrylamide gel electrophoresis IgE immunoblot correlated with RAST activity. C. cyathiformis and Ps. cubensis spores have thick walls, whereas P1. ostreatus and L. edodes spore walls are thin and hyaline (nonpigmented). Thus spore allergen release may relate to spore wall characteristics. CONCLUSIONS: These studies indicate that intact basidiospores of all four species release allergens, but the release patterns differ by species, and these differences may be clinically significant.

PMID: 8349941, UI: 93352987

Curr Genet 1993 Jul;**24(1-2):**114-121

A nucleotide sequence involved in replicative transformation of a filamentous fungus.

Peng M, Lemke PA, Singh NK

Replicative plasmids generated through in-vivo recombination have been identified among transformants of the fungus Pleurotus ostreatus. In addition to sequences from a standard selection vector (pAN7-1), these recombinant plasmids contain recombined sequences of chromosomal origin conferring replicative potential upon the vector. One such recombined sequence, an 1148-bp insert into plasmid pP01, has been characterized. This sequence has been analyzed for secondary structural features as well as for consensus sites affiliated with origins of replication (ori) in other eukaryotic systems. The 1148-bp insert lacks an ORF and does not contain an acceptable match to the commonly identified 11-bp ars consensus sequence (A/TTTTATA/GTTTA/T) for autonomous replication in the yeast Saccharomyces cerevisiae. The analysis, however, revealed a cluster of three hairpin-loop-forming subsequences with individual delta G25 degrees C free energy values of -7.6, -6.4 and -5.2 kcal mol-1. Also found were two 7-bp analogues to centromere-affiliated sequences recognized in other fungi, as well as several putative

gyrase recognition sites comparable to the 9-bp S. cerevisiae/E. coli gyrase-binding consensus sequence. Sequences comparable to the ori of the yeast 2-microns plasmid or to various sequences associated with ori of yeast/fungal mitochondrial DNAs (mtDNA) were not present in the 1148-bp insert. Replication of pP01 appears rather to involve a replication of chromosomal derivation devoid of an ars-type consensus.

PMID: 8358817, UI: 93365019

Allergy Proc 1993 Jul;**14(4):**263-268

Protease activity in cockroach and basidiomycete allergen extracts.

Wongtim S, Lehrer SB, Salvaggio JE, Horner WE

Inherent proteolytic activity was estimated in cockroach and basidiomycete extracts by quantifying acid soluble peptides that were released by incubating extracts with 1% bovine serum albumin as measured by Lowry (Sigma). Reference proteases released 740 (Proteinase K, 0.1 U), 248 (Trypsin, 1.0 U), and 533 micrograms/ml (Pronase, 0.5 U) of soluble peptides. American whole body cockroach extract (0.1 mg dry weight) released 330 micrograms/ml of soluble peptides, representing 13 trypsin equivalent units (TEU)/mg. Extracts from spores of the mushroom Pleurotus ostreatus released 230 micrograms/ml (0.9 TEU/mg) and Pleurotus cap extract released 112 micrograms/ml (0.5 TEU/mg). Mycelium of Pleurotus and the mushroom Psilocybe cubensis and spores of Psilocybe and the puffball Calvatia cyathiformis showed negligible amounts of proteolytic activity. The protease inhibitor phenylmethylsulfonyl flouride reduced the proteolytic activity of American whole body cockroach extract by 80% (@1 mM) and the inhibitor ethylene diaminetetraacetic acid inhibited the proteolytic activity of Pleurotus spores by 95% (@1 mM). Loss of allergen activity as determined by RAST inhibition and immunoprinting correlated with protease activity. Thus, in the preparation and handling of allergen extracts, one should employ conditions that minimize proteolysis.

PMID: 8224832, UI: 94040704

Appl Microbiol Biotechnol 1993 Jul;**39(4-5):**632-636

Stability and activity of a phenol oxidase from the ligninolytic fungus Pleurotus ostreatus.

Palmieri G, Giardina P, Marzullo L, Desiderio B, Nitti G, Cannio R, Sannia G

Three different phenol oxidases produced by the basidiomycete fungus Pleurotus ostreatus have been isolated and their main structural, enzymatic and physico-chemical properties characterized. Studies have focused on the most abundantly secreted of these proteins, a copper-enzyme specific towards ortho-diphenol substrates. This protein was purified to homogeneity and part of its primary structure determined by direct protein sequencing. The influence of pH, temperature and presence of water-soluble or water-insoluble organic solvents on the activity and stability of the enzyme were also investigated. These data can be used for applying bioreactors to problems of environmental concern such as waste-water treatment.

PMID: 7763931, UI: 93356991

Biochim Biophys Acta 1993 May 13;**1163(2):**158-164

Purification and characterisation of an extracellular peroxidase from

white-rot fungus Pleurotus ostreatus.

Kang SO, Shin KS, Han YH, Youn HD, Hah YC

A peroxidase was purified 98.3-fold from the culture filtrate of Pleurotus ostreatus with an overall yield of 12.4%. The molecular mass determined by gel filtration was found to be approx. 140 kDa. SDS-PAGE revealed that the enzyme consists of two identical subunits with a molecular mass of approx. 72 kDa. The pI value of this enzyme is approx. 4.3. The enzyme contains 41% carbohydrate by weight, and aspartic acid and asparagine (16.8%), and glutamic acid and glutamine (12.0%). The enzyme has the highest affinity toward synaptic acid and affinity towards various phenolic compounds containing methoxyl and p-hydroxyl groups, directly attached to the benzene ring. However, the enzyme does not react with veratryl alcohol and shows no affinity for nonphenolic compounds. The optimal reaction pH and temperature are 4.0 and 40 degrees C, respectively. The catalytic mechanism of the enzymic reaction is of the Ping-Pong type. The activity of the enzyme is competitively inhibited by high concentrations of H2O2 and its Ki value is 1.70 mM against H2O2. This enzyme contains approx. 1 mol of heme per mol of one subunit of the enzyme. The pyridine hemochrome spectrum of the enzyme indicates that the heme of P. ostreatus peroxidase is iron protoporphyrin IX. The EPR spectrum of the native peroxidase shows the presence of a high-spin ferric complex with g values at 6.102, 5.643 and 1.991.

PMID: 8387825, UI: 93257482

Mol Gen Genet 1993 Feb;**237(1-2):**1-9

Bending of DNA segments with Saccharomyces cerevisiae autonomously replicating sequence activity, isolated from basidiomycete mitochondrial linear plasmids.

Nakajima M, Sheikh QI, Yamaoka K, Yui Y, Kajiwara S, Shishido K

Previous studies have indicated that DNA bending is a general structural feature of sequences (ARSs) from cellular DNAs of yeasts and nuclear and mitochondrial genomic DNAs of other eukaryotes that are capable of autonomous replication in Saccharomyces cerevisiae. Here we showed that bending activity is also tightly associated with S. cerevisiae ARS function of segments cloned from mitochondrial linear DNA plasmids of the basidiomycetes Pleurotus ostreatus and Lentinus edodes. Two plasmids, designated pLPO2-like (9.4 kb), and pLPO3 (6.6 kb) were isolated from a strain of P. ostreatus. A 1029 bp fragment with high-level ARS activity was cloned from pLPO3 and it contained one ARS consensus sequence (A/T)TTTAT(A/G)TTT(A/T) indispensable for activity and seven dispersed ARS consensus-like (10/11 match) sequences. A discrete bent DNA region was found to lie around 500 bp upstream from the ARS consensus sequence (T-rich strand). Removal of the bent DNA region impaired ARS function. DNA bending was also implicated in the ARS function associated with a 1430 bp fragment containing three consecutive ARS consensus sequences which had been cloned from the L. edodes plasmid pLLE1 (11.0 kb): the three consecutive ARSs responsible for high-level ARS function occurred in, and immediately adjacent to, a bent DNA region. A clear difference exists between the two plasmid-derived ARS fragments with respect to the distance between the bent DNA region and the ARS consensus sequence(s).

PMID: 8455547, UI: 93204881

Vet Med (Praha) 1993;**38(7):**395-402

[Delayed hypersensitivity and the primary antibody reaction after administration of infectious bovine rhinotracheitis inactivated oil vaccine

to calves premedicated with glucan].

[Article in Slovak]

Paulik S, Bajova V, Benko G

The level of delayed skin hypersensitivity (DSH) to DNFB and of the primary immune reaction was evaluated in the calves immunized with an inactivated oil IBR vaccine (V group) and in the calves premedicated with glucan (seven days before vaccine administration) and subsequently immunized with the mentioned vaccine (GV group). The DSH test did not reveal an alteration of cellular immunological reactivity in the calves immunized with an inactivated oil IBR vaccine; after the vaccine administration there was no significant difference in the DSH level from the value before vaccine administration nor in comparison with the value of control calves (K group), Tab. I. But in the immunized calves which were glucan-premedicated (from Pleurotus ostreatus; 10 mg/kg l.w.) a significantly higher DSH level was determined not only in comparison with the initial value ($P < 0.05$) before glucan administration but also with the value of control calves ($P < 0.05$), Tab. I. The categorization of calves according to the DSH level also points to the immunomodulating effect of glucan in this sense (Fig. 1); while the value of skin test ranged from 3.6 to 6.5 mm in the highest percentage of the calves of V and K groups on the dates before and after administration of the mentioned preparations, a marked increase (on the date after administration) in the number of calves (from 22 to 67%) with the value of skin test higher than 6.5 mm was observed in the calves of GV group. The vaccine administration in itself (V group) did not induce the production of measurable amounts of serum IBR antibodies till day 14 after immunization.

PMID: 8379100, UI: 93392382

Ann Nutr Metab 1993;**37(3):**142-145

The mushroom Pleurotus ostreatus reduces secretion and accelerates the fractional turnover rate of very-low-density lipoproteins in the rat.

Bobek P, Kuniak L, Ozdin L

In male rats fed a diet containing 1.5% cholesterol and 5% of dried mushroom (Pleurotus ostreatus) a significantly reduced accumulation of cholesterol in serum (by 45%) and the liver (by 15%) was observed at the end of the 12th week of the experiment. The decrease in serum cholesterol level by more than 90% is a consequence of the decreased cholesterol concentration of very-low-density lipoproteins (VLDL) and of low-density lipoproteins. Consumption of P. ostreatus reduces the total VLDL entry into the circulation by 19% and accelerates (by 49%) fractional turnover rate of VLDL.

PMID: 8373138, UI: 93384243

J Basic Microbiol 1993;**33(4):**269-277

Metabolism of PAH by fungi and correlation with extracellular enzymatic activities.

Sack U, Gunther T

The activity to metabolize the polycyclic aromatic hydrocarbons (PAH) phenanthrene, anthracene, pyrene, fluorene and fluoranthene by Trametes versicolor, Pleurotus ostreatus (white rot fungi), Laetiporus sulphureus,

Daedaela quercina, Flamulina velutipes (brown rot fungi), Marasmiellus sp. (litter decaying fungus) and Penicillium sp. M 1 (isolated from a PAH contaminated soil sample) were compared. Screening methods for the presence of exoenzymes (peroxidases, polyphenoloxidases, "radical generating" enzymes) were evaluated for their use in screenings for fungi degrading PAH. Laetiporus sulphureus and Penicillium sp. M 1 cometabolize several PAH with rates comparable to white rot fungi. In most of the cases the patterns of extracellular peroxidases indicate the potential of fungi to degrade PAH.

PMID: 8229670, UI: 94046448

Physiol Res 1993;**42(3):**175-179

Effect of the oyster fungus on glycaemia and cholesterolaemia in rats with insulin-dependent diabetes.

Chorvathova V, Bobek P, Ginter E, Klvanova J

We have investigated the effect of a diet containing of 4% oyster fungus (Pleurotus ostreatus) and 0.1% cholesterol on glycaemia and hyperlipoproteinaemia in rats with insulin-dependent diabetes (streptozotocin 45 mg/kg). After two months, the rats with diabetes kept on the oyster fungus diet, had a significantly lower basal and postprandial glycaemia, the insulinaemia remained unchanged. The cholesterol concentration was decreased by more than 40%, the lipoprotein profile was upgraded by the decrease of the cholesterol in both the low density and very low density lipoproteins. The oyster fungus decreased the cholesterol accumulation in the liver and had no significant effects on the levels of serum and liver triacylglycerols.

PMID: 8218150, UI: 94032195

Nahrung 1993;**37(6):**571-575

Influence of water and ethanol extracts of the oyster mushroom (Pleurotus ostreatus) on serum and liver lipids of the Syrian hamsters.

Bobek P, Ozdin L, Kuniak L

Extracts from the dried and ground fungus were prepared with water and with 30%, 60% and 85% ethanol, and thickened in vacuum. The whole fungus and extracts were added to the hyperlipidemic diet in amounts equivalent to 3% of the whole fungus. After 6 weeks the whole fungus, its water as well as 30% and 60% ethanol extracts have significantly reduced the contents of cholesterol (C) and triacylglycerols (TG) in the serum. The C and TG contents of the liver were reduced by 34-48% (in the case of TG insignificantly when applying the water and 60% ethanol extracts). The 85% ethanol extracts reduced the C and TG levels in both serum and liver statistically insignificantly by 18-22%. The reduction of serum C by addition of the whole fungus and its water and 30% ethanol extract was decisively affected by the reduction in the C contents in the very low density fraction of lipoproteins.

PMID: 8121469, UI: 94166856

Physiol Res 1993;**42(6):**175-179

Effect of the oyster fungus on glycaemia and cholesterolaemia in rats with insulin-dependent diabetes.

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PMID: 7710476, UI: 94235583

Vet Med (Praha) 1992 Dec;**37(12):**675-685

[The effect of fungal and yeast glucan and levamisole on the level of the cellular immune response in vivo and leukocyte phagocytic activity in mice].

[Article in Slovak]

Paulik S, Svrcek S, Huska M, Mojzisova J, Durove A, Benisek Z

The level of cell-mediated immune response in vivo was investigated using the test of delayed hypersensitive reaction (DHR) to DNFB, along with the phagocytic activity (PA) of blood leucocytes in mice after subcutaneous implantation of fungal and yeast glucan and levamisol in dependence on the dose and administration schedule. The soluble form of fungal glucan (Pleurotus ostreatus) potentiated the DHR significantly at a dose of 10 mg/kg (but not at a dose of 50 mg/kg) while it was administered during DNFB sensitization ($P < 0.05$)-Tab. I and when its pre-medication effect was investigated (days -7 and -14; $P < 0.05$) with regard to the time of sensitization (Tab. II). The identical dose of glucan also had a positive effect ($P < 0.05$ or 0.01) on the percentual proportion of phagocytic cells (PC) reaching the maximum in the 2nd and 3rd week of investigation, as well as on the phagocytic activity index ($P < 0.05$; 3rd week) and percentage of neutrophil granulocytes ($P < 0.05$; 2nd week)-Tab. III. Yeast glucan (Saccharomyces cerevisiae) showed a potentiating effect on the DHR to DNFB only in the case of its pre-medication use; its soluble form was effective at both doses (10 mg and 50 mg/kg) in days -7 and -14 ($P < 0.05$), and its corpuscular form at a dose of 50 mg/kg on days -7, -14 and -21 ($P < 0.05$ or 0.01)-Tab. II. PA parameters of blood leucocytes displayed a stimulative effect only on the PC percentage. The most significant effects in this case were observed in the soluble form (both doses) in the 2nd and 3rd week ($P < 0.01$ and 0.05, resp.) and in the insoluble form (both doses) in the 3rd and 4th week of observation ($P < 0.05$ and 0.01, resp.). An increase in the number of neutrophil granulocytes was significant in the 2nd ($P < 0.05$ or 0.01; corpuscular form) and 3rd week of the experiment ($P < 0.01$; soluble form)-Tab. III. Levamisol affected both investigated parameters (DHR and PA) only at a dose 20 mg/kg (10 mg/kg-no effect). Its potentiating effect on the DHR level was observed both for its administration at the time of sensitization ($P < 0.05$) and for its administration on days 7 ($P < 0.05$) and 14 ($P < 0.01$) before DNFB sensitization (Tabs. I and II). A statistically significant increase in PC was recorded in weeks 2, 3 and 4 ($P < 0.05$ or 0.01), a statistically significant increase in the number of neutrophil granulocytes in the 3rd week of investigation ($P < 0.05$). The phagocytic activity index was not affected.

PMID: 1297245, UI: 93212455

Appl Environ Microbiol 1992 Oct;**58(10):**3225-3232

Fungal biodegradation of lignopolystyrene graft copolymers.

Milstein O, Gersonde R, Huttermann A, Chen MJ, Meister JJ

White rot basidiomycetes were able to biodegrade styrene (1-phenylethene) graft copolymers of lignin containing different proportions of lignin and polystyrene [poly(1-phenylethylene)]. The biodegradation tests were run on lignin-styrene copolymerization products which contained 10.3, 32.2, and 50.4% (wt/wt) lignin. The polymer samples were incubated with the white rot fungi Pleurotus ostreatus, Phanerochaete chrysosporium, and Trametes versicolor and the brown rot fungus Gloeophyllum trabeum. White rot fungi degraded the plastic samples at a rate which increased with increasing lignin content in the copolymer sample. Both polystyrene and lignin components of the copolymer were readily degraded. Polystyrene pellets were not degradable in these tests. Degradation was verified for both incubated and control samples by weight loss, quantitative UV spectrophotometric analysis of both lignin and styrene residues, scanning electron microscopy of the plastic surface, and the presence of enzymes active in degradation during incubation. Brown rot fungus did not affect any of the plastics. White rot fungi produced and secreted oxidative enzymes associated with lignin degradation in liquid media during incubation with lignin-polystyrene copolymer.

PMID: 1444360, UI: 93073845

Curr Genet 1992 Jul;**22(1):**53-59

Recovery of recombinant plasmids from Pleurotus ostreatus transformants.

Peng M, Singh NK, Lemke PA

A transformation system employing selectable resistance to hygromycin B has been developed for the mushroom-forming fungus, Pleurotus ostreatus. Vector pAN7-1, a commonly used non-replicative vector for integrative transformation in fungi, yielded 5-46 resistant colonies per micrograms of DNA per 10(7) viable protoplasts. Southern blot analysis of certain transformants revealed unexpected replicative plasmids containing pAN7-1 sequences, but modified for size, methylation and restriction enzyme pattern when compared to the initial transforming vector. Two such replicative derivatives of pAN7-1 have been rescued from P. ostreatus by cloning into Escherichia coli. Rescued plasmids have been used to probe DNA from untransformed P. ostreatus in an effort to identify fungal sequences that recombined in vivo with pAN7-1 to form replicative plasmids. Such replicative sequences have been localized in high molecular weight (chromosomal) DNA of wild-type P. ostreatus. Transformation has been obtained for P. ostreatus using a rescued plasmid, thereby confirming the role of this recombinant plasmid as a shuttle vector.

PMID: 1611668, UI: 92306168

Pharmazie 1992 May;**47(5):**393

The effect of the mushroom Pleurotus ostreatus on the lipid peroxidation of phosphatidylcholine liposomes.

Filipek J

PMID: 1409836, UI: 93028720

Sci Total Environ 1991 Jun;**105:**29-39

Concentrations of radiocesium and potassium in basidiomycetes collected in Japan.

Muramatsu Y, Yoshida S, Sumiya M

Concentrations of 137Cs, 134Cs and 40K in about 60 mushroom samples (fruit bodies of basidiomycetes) belonging to 25 species collected in Japan have been studied. The levels of 137Cs varied very widely, ranging from less than 3 to 1520 Bq kg-1 (dry wt), while those of 40K were relatively constant. Concentrations of 137Cs in common edible mushrooms of Japan such as Lentinus edodes, Flammulina velutipes, Pleurotus ostreatus and Pholiota nameko were low (normally less than 50 Bq kg-1, dry wt). Concentrations of 134Cs in many samples were below the limit of detection (usually less than 5 Bq kg-1, dry wt). The median concentrations of 137Cs and 40K were 41 (dry wt) and 1150 Bq kg-1 (dry wt), respectively. From the 137Cs/40K ratios it was found that cesium rather than potassium was selectively taken up from the soils by fungi such as Suillus granulatus and Lactarius hatsudake. The 134Cs/137Cs ratios in mushrooms are related to the depth of the mycelium in the soil. The effective dose equivalent due to the dietary intake of radiocesium through mushrooms was estimated to be only 1.6 x 10(-7) Sv.

PMID: 1925522, UI: 92022497

Nutrition 1991 Mar;**7(2):**105-108

Effect of mushroom Pleurotus ostreatus and isolated fungal polysaccharide on serum and liver lipids in Syrian hamsters with hyperlipoproteinemia.

Bobek P, Ginter E, Kuniak L, Babala J, Jurcovicova M, Ozdin L, Cerven J

In Syrian hamsters, a diet with 44% of the calories being fat and containing 52 mg cholesterol (C)/100 g induced an accumulation of blood plasma and liver C and triacylglycerol (TG). In these animals, we studied the effect of dried whole mushroom (Pleurotus ostreatus, 2% in the diet, 6-mo experiment) and ethanol-insoluble residue and structurally defined fungal polysaccharide, both isolated from the mushroom (in both cases, 4% in the diet, 2-mo experiments) on C and TG concentration in serum and liver. Whole mushroom effectively retarded the increase in C and TG in both serum and liver throughout the experiment. The mushroom also reduced the content of all lipids in lipoproteins with densities of less than 1.006 to less than 1.063 g/ml. Very-low-density lipoproteins played a substantial role in the decrease (65-80%) in serum lipids. As a result, the lipoprotein concentration of the specified density classes was reduced by 45-60%, and the concentration of the serum lipoprotein pool was reduced by 40%. Neither the chemical composition of high-density lipoproteins nor their serum concentration was affected by the mushroom. Ethanol-insoluble mushroom residue did not significantly affect serum lipid levels, but it reduced liver TG content. Fungal polysaccharide lowered the C content in serum and liver.

PMID: 1802191, UI: 92199908

Neth J Med 1991 Feb;**38(1-2):**59-64

Provocation tests in extrinsic allergic alveolitis in mushroom workers.

Kamm YJ, Folgering HT, van den Bogart HG, Cox A

The clinical diagnosis of extrinsic allergic alveolitis can be supported by a positive provocation test. Twenty-eight

common mushroom (Agaricus bisporus) workers, 4 oyster mushroom (Pleurotus ostreatus) workers and 6 Shii Take mushroom (Lentinus edodes) workers, whose medical history indicated a possible extrinsic allergic alveolitis, were examined. The provocation test consisted of a control day, an exposure day, and half a day of follow-up observation. On the control and exposure days, the body temperature, leucocyte count and lung function were measured every 2 h. The chest X-ray and arterial blood gas sample were taken once. The exposure consisted of a 1-h presence on the common mushroom farm in spawning conditions or inhaling a suspension of spores of Pleurotus or Shii-Take in the laboratory. Eighteen of the 28 people employed on the common mushroom farm, all 4 Pleurotus workers and 4 of the 6 Shii-Take workers were diagnosed as having extrinsic allergic alveolitis, according to the following criteria: a positive history and 2 or more of the following findings: increase in leucocyte count, rise in temperature and decrease in inspiratory vital capacity (IVC) and total lung capacity (TLC).

PMID: 2030812, UI: 91232682

Biochim Biophys Acta 1991 Jan 23;**1073(1):**114-119

Purification and characterization of a veratryl alcohol oxidase enzyme from the lignin degrading basidiomycete Pleurotus ostreatus.

Sannia G, Limongi P, Cocca E, Buonocore F, Nitti G, Giardina P

A veratryl alcohol oxidase (VAO) enzyme was discovered in cultures of Pleurotus ostreatus. The enzyme, which oxidizes veratryl alcohol to veratraldehyde reducing O2 to H2O2, was purified to homogeneity and its main structural and catalytic properties have been determined. The enzyme is a glycoprotein and contains FAD as a prosthetic group. The amino acid composition and carboxy- and amino-terminal sequences were determined. Primary aromatic alcohols with methoxy substituents in position four are good substrates for VAO; cinnamyl alcohol is the substrate which is oxidized faster whereas coniferyl alcohol is oxidized at a slower rate. The enzyme is moderately thermostable (t1/2(55 degrees C) about 1.5 h, apparent melting temperature about 60 degrees C). The enzyme stability in 50% water/organic solvents mixtures has also been studied.

PMID: 1991127, UI: 91120798

Ann Nutr Metab 1991;**35(4):**191-195

Cholesterol-lowering effect of the mushroom Pleurotus ostreatus in hereditary hypercholesterolemic rats.

Bobek P, Ginter E, Jurcovicova M, Kuniak L

We studied the effect of the edible mushroom Pleurotus ostreatus (4% in diet containing 1% of cholesterol) on serum and liver lipids in female rats with hereditary enhanced sensitivity to alimentary cholesterol. We found that the consumption of the mushroom-containing diet prevented serum cholesterol increase which was manifested at the end of the 4th week of the experiment. At the end of the 7th week of the experiment the cholesterolemia was lowered by almost 40% as compared with control animals kept on the same diet but without the mushroom. The decrease in serum cholesterol levels is a consequence of the decreased cholesterol concentrations of very-low-density lipoproteins and of low-density lipoproteins.

PMID: 1897899, UI: 91378191

Physiol Res 1991;**40(3):**327-332

Effect of oyster fungus (Pleurotus ostreatus) on serum and liver lipids of Syrian hamsters with a chronic alcohol intake.

Bobek P, Ginter E, Jurcovicova M, Ozdin L, Mekinova D

The authors studied the effect of oyster fungus (Pleurotus ostreatus) (2% dried fruiting bodies in a standard diet) on the serum and liver lipids of growing male Syrian hamsters with a chronic alcohol intake (a 15% aqueous solution). After eight weeks' alcohol intake there was an increase in their serum cholesterol, triacylglycerol (TG) and phospholipid (PL) concentration, 40 - 60% of which was accounted for by an increase in the very low density lipoprotein (VLDL) concentration. The proportion of VLDL in the lipoprotein pool rose by almost 15%, whereas the proportion of high density lipoproteins (HDL) fell. The simultaneous administration of the fungus in the diet reduced the cholesterol level below the value in the control animals not given any alcohol. Both the serum TG and the VLDL concentration fell by 30%, but neither the chemical composition and concentration of the HDL nor the cholesterol concentration were affected. The addition of the fungus to the diet completely abolished the increase induced in the liver cholesterol and TG concentration by the chronic intake of alcohol.

PMID: 1751479, UI: 92089058

Eisei Shikenjo Hokoku 1991;**109:**98-99

[Survey of radiocesium in domestic mushrooms on the market].

[Article in Japanese]

Kawamura Y, Uchiyama S, Saito Y

Domestic mushrooms on the market were tested for concentration of radiocesium; cesium-134 and 137 by gamma-ray spectrometer. Cesium-137 was detected in most samples of dried and raw shiitake (Lentinus edodes (Berk.) Sing.). The concentrations were from 6.7 to 73.9 Bq/kg in dried ones and from 1.3 to 6.4 Bq/kg in raw ones. It was not detected in enokitake (Flammulina veltipes (Fr.) Sing.) and shimeji (Lyophyllum aggregatum (Secr.) Kuhner and Pleurotus ostreatus (Fr.) Quel.). Cesium-134 was not found in all samples.

PMID: 1364413, UI: 95004447

Food Chem Toxicol 1990 Sep;**28(9):**607-611

A study of the mutagenicity of some commercially canned Spanish mushrooms.

Morales P, Bermudez E, Sanz B, Hernandez PE

The mutagenicity of two wild (Lactarius deliciosus and Boletus luteus) and two cultivated (Agaricus bisporus and Pleurotus ostreatus) mushrooms, preserved by canning and widely consumed in Spain, was studied in the Ames Salmonella/microsome test and in the CHO/HPRT assay system using mammalian cells. The mushroom extracts did not show mutagenicity in the microbial Ames test nor in the mammalian CHO-K1 cells, and this response was not modified by the presence of S-9 mix in the assay mixtures. Only the extracts from P. ostreatus showed a weak mutagenic activity in the CHO/HPRT assay in the presence of a metabolic activation system (S-9).

PMID: 2272557, UI: 91106849

Clin Exp Allergy 1990 Sep;**20(5):**533-538

Evaluation of Basidiomycete and Deuteromycete (Fungi Imperfecti) extracts for shared allergenic determinants.

O'Neil CE, Horner WE, Reed MA, Lopez M, Lehrer SB

Aqueous extracts of select members of the Basidiomycetes and Deuteromycetes (Fungi Imperfecti) were evaluated for the presence of shared allergenic determinants using skin prick and radio-allergosorbent test (RAST) inhibition. Twenty adults with perennial symptoms of rhinitis, with or without asthma, were skin-prick tested with six species of Deuteromycetes and seven species of Basidomycetes. Positive weal-and-flare reactivity to Pleurotus ostreatus was associated with Alternaria alternata, Fusarium solani and Epicoccum purpurescens. Positive skin reactivity to Calvatia cyathiformis was also associated with A. alternata and F. solani. Coprinus quadrifidus was associated only with F. solani, and Psilocybe cubensis was only associated with Aspergillus fumigatus. No other skin test associations were demonstrated. For every allergen tested by RAST inhibition, significant dose-dependent homologous inhibition was demonstrated. Although the ability of an individual heterologous extract to inhibit the direct RAST varied, inhibition was generally minimal. In the most extreme example, no heterologous allergen inhibited the A. alternata RAST. However, the Armillaria tabescens RAST was inhibited 52.6%, 38.1% and 25.1% by A. fumigatus, E. purpurescens, and Penicillium notatum, respectively, suggesting significant cross-reactivity. These results suggest that, although shared allergenic determinants exist between select species of Basidiomycetes and Deuteromycetes, crossreactivity is minimal and its clinical significance is not clear. These data confirm that for reliable diagnosis of fungal allergy, representatives of both major groups must be used.

PMID: 2253084, UI: 91070349

Ecotoxicol Environ Saf 1990 Aug;**20(1):**1-6

Response of Pleurotus ostreatus to cadmium exposure.

Favero N, Bressa G, Costa P

The possibility of utilizing agroindustrial wastes in the production of edible, high-quality products (e.g., mushrooms) implies the risk of bringing toxic substances, such as heavy metals, into the human food chain. Thus, growth in the presence of cadmium and cadmium accumulation limits have been studied in the industrially cultivated fungus P. ostreatus. Fruit body production is substantially unaffected in the presence of 25, 139, and 285 mg Cd/kg of dried substrate. Cadmium concentration in fruit bodies is related to cadmium substrate level, the metal being present at higher levels in caps (22-56 mg/kg dry wt) than in stems (13-36 mg/kg dry wt). Concentration factor (CF), very low in the controls (about 2), further decreases in treated specimens. The presence of a cadmium control mechanism in this fungi species is suggested. Fruit body cadmium levels could, however, represent a risk for P. ostreatus consumers, according to FAO/WHO limits related to weekly cadmium intake.

PMID: 2226238, UI: 91031129

J Allergy Clin Immunol 1990 Jul;**86(1):**26-33

Evidence for cross-reactive allergens among basidiomycetes: immunoprint-inhibition studies.

De Zubiria A, Horner WE, Lehrer SB

Allergenic cross-reactivity among six basidiomycete species (Calvatia cyathiformis, Coprinus quadrifidus, Psilocybe cubensis, Pleurotus ostreatus, Ganoderma meredithae, and Pisolithus tinctorius) was determined by immunoprint inhibition. Extensive cross-reactivity was demonstrated among Coprinus quadrifidus, Psilocybe cubensis, and Pleurotus ostreatus of the order Agaricales, and Calvatia cyathiformis of the order Lycoperdales. However, G. meredithae (order Aphyllophorales) and Pisolithus tinctorius (order Sclerodermatales) did not demonstrate significant cross-reactivity with the other basidiomycete species. Generally, the two most potent inhibitors were Psilocybe cubensis and Pleurotus ostreatus. Inhibitory dose-response curves of a major allergenic band (isoelectric point, 9.3) were obtained by densitometry. Significant cross-reactivity was demonstrated for the 9.3 band among the species of the order Agaricales and with Calvatia cyathiformis. The most potent inhibitors were again Psilocybe cubensis and Pleurotus ostreatus. Thus, there is substantial allergenic cross-reactivity among the species of the order Agaricales tested and with Calvatia cyathiformis but not between these four species and G. meredithae or Pisolithus tinctorius. These studies support earlier RAST-inhibition observations of shared allergenic epitopes among basidiomycetes, especially epitopes within the Agaricales. The presence of shared epitopes suggests the possibility of devising a panel of skin test reagents representative of a large group of basidiomycetes.

PMID: 2196301, UI: 90317216

Gene 1990 Apr 30;**89(1):**145-150

Characterization of lignin peroxidase-encoding genes from lignin-degrading basidiomycetes.

Huoponen K, Ollikka P, Kalin M, Walther I, Mantsala P, Reiser J

Two closely linked lignin peroxidase (LPO)-encoding genes (lpo) from Phanerochaete chrysosporium were isolated. Nucleotide sequence studies indicated that the two genes are separated by 1.3 kb of flanking DNA and transcribed in opposite directions. Cloned P. chrysosporium lpo gene probes have been shown to hybridize to multiple sequences present in the DNAs of the white-rot fungi, Bjerkandera adusta, Coriolus versicolor and Fomes lignosus, but no hybridization was detected with DNA from Pleurotus ostreatus. Thus, lpo gene families appear to be common in a number of lignin-degrading basidiomycetes, some of which have not yet been shown to produce LPO proteins.

PMID: 2373364, UI: 90323600

J Allergy Clin Immunol 1988 Dec;**82(6):**978-986

Characterization of allergens from spores of the oyster mushroom, Pleurotus ostreatus.

Horner WE, Ibanez MD, Liengswangwong V, Salvaggio JE, Lehrer SB

Crude extracts of Pleurotus ostreatus spores obtained from a single local source were fractionated by gel filtration to resolve the allergenic components. The fraction pool corresponding to 10.5 to 25 kd molecular weight contained allergenic activity as demonstrated by both RAST and skin testing. Similar results were obtained with extracts from spores that originated in four other areas and with extracts prepared from P. sajor-caju spores obtained from commercially produced caps. The RAST-active fraction was further separated by hydrophobic interaction chromatography (HIC). HIC fraction pools were assayed for allergen(s) by RAST inhibition and immunoblotting of isoelectric focused polyacrylamide gels. RAST-inhibition data indicated that the allergen(s) was reversibly bound to the HIC column, eluting with 2, 1, and 0.15 mol/L of buffered salt solutions. After electrofocusing, these fractions yielded 15, 12, and 11 Coomassie brilliant blue-staining bands, respectively. IgE binding occurred with 7, 8, and 6

of these bands, as revealed by radiostaining of the immunoblots. These procedures help identify P. ostreatus spore allergens and allow a greater degree of standardization in the preparation of allergen extracts from basidiospores for use in diagnosis and therapy of fungal allergy.

PMID: 3204256, UI: 89080076

Biochim Biophys Acta 1988 Nov 10;**951(1):**53-60

Two linear plasmid-like DNA elements simultaneously maintained in Pleurotus ostreatus.

Yui Y, Katayose Y, Shishido K

Two linear plasmid-like DNA elements, designated pLP01 and pLP02, have been isolated from a strain of Pleurotus ostreatus, an edible basidiomycete. pLP01 (10.0 kb) and pLP02 (9.4 kb) were found in mitochondrial preparations of the fungus and appear to have 5' ends blocked by association of a protein. Proteinase K cleavability of the 5'-terminal protein of pLP01 was higher than that of pLP02, indicating that the terminal proteins of both plasmid-like elements are distinct from one another. pLP01 and pLP02 were estimated to be present to the extent of 1-2 copies each per mitochondrial genome equivalent. The two plasmid-like elements had no homology between them and also were not homologous with the mitochondrial and nuclear genomic DNAs of the fungus.

PMID: 2847798, UI: 89051019

Rev Biol Trop 1988 Nov;**36(2A):**255-260

[Cultivation of Pleurotus ostreatus and allied species (Fungi: Pleurotaceae) upon semi-sterile natural media].

[Article in Spanish]

Macaya-Lizano AV

Pleurotus ostreatus (Jacq. ex Fr.) Quelet and its allies are edible mushrooms whose cultivation is successful in parts of Europe and Asia. In Costa Rica only Agaricus bisporus has been commercially cultured, but requires elaborate facilities. The use of waste material (e.g. sawdust, rice straw, sugar cane debris) and non-controlled environmental conditions suitable for easy artisanal cultivation of Pleurotus ostreatus is reported here.

PMID: 3238078, UI: 89185802

Ecotoxicol Environ Saf 1988 Oct;**16(2):**85-89

Bioaccumulation of Hg in the mushroom Pleurotus ostreatus.

Bressa G, Cima L, Costa P

The possibility of utilizing industrial, urban, and other wastes for the growth of a product which is directly edible by humans is fascinating. However, it is possible that many wastes containing toxic substances, for example, heavy metals, could reach the food chain and produce adverse effects on human health. To this end, we studied the possibility of bioaccumulation of Hg by a mushroom, Pleurotus ostreatus, grown on an artificial compost containing

this element. Concentrations of 0.05, 0.1, and 0.2 mg/kg of Hg as Hg(NO3)2.H2O were added to three groups of the same compost, successively inoculated with the mycelia of the mushroom. Higher concentrations strongly reduced the growth of the mycelia and therefore were not utilized. The concentrations of Hg in the substrate and in the mushroom were evaluated by AAS. The range of the accumulation factor was found to be 65-140, i.e., very marked. This finding suggests that the cultivation of P. ostreatus on substrates containing Hg from industrial and urban wastes could involve possible risks to human health.

PMID: 3234295, UI: 89170410

Eur Respir J 1988 May;**1(5):**466-468

Extrinsic allergic alveolitis caused by spores of the oyster mushroom Pleurotus ostreatus.

Cox A, Folgering HT, van Griensven LJ

Four mushroom workers have developed an extrinsic allergic alveolitis, after working with the oyster mushroom (Pleurotus ostreatus). After provocation with aerosolized spores under laboratory conditions, the four patients showed the complaints of an extrinsic allergic alveolitis; a rise of body temperature, leucocytosis and changes of lung function parameters were observed. Antibodies against the spores were assessed in the blood of these patients.

PMID: 3169217, UI: 89005564

Prikl Biokhim Mikrobiol 1988 Mar;**24(2):**164-169

[Biosynthesis of vitamins B by the fungus Pleurotus ostreatus in a submerged culture].

[Article in Russian]

Solomko EF, Eliseeva GS

The intra- and extracellular contents of vitamins were studied in the course of submerged cultivation of the higher basidial mushroom Pleurotus ostreatus (Jacq.: Fr.) Kummer st. IMBF-1300 on liquid nutrient media. This strain was found to be autotrophic in respect of thiamin (vitamin B1), riboflavin (vitamin B2), niacin (vitamin B5), pyridoxine (vitamin B6) and biotin (vitamin B7), but it failed to synthesize cyanocobalamin (vitamin B12). The composition and pH of the culture medium, containing such complex biostimulating supplements as maize extract and concentrated potato sap noticeably influence the contents of vitamins B1, B5 and B7 in the mycelium, and to a less degree they change the level of the intracellular biosynthesis of vitamins B2 and B6. Higher excretion of vitamins B5, B7 and especially B6 was observed on the semisynthetic media during the postexponential growth. Under experimental conditions vitamins B1 and B2 were accumulated only in the cells. The dry mycelium of P. ostreatus obtained by submerged cultivation on liquid media is a valuable source of B vitamins and, especially, of niacin. Thus the oyster mushroom and other edible mushrooms can be put at one of the top places among food-stuffs by the content of niacin.

PMID: 3290883, UI: 88262894

Int Arch Allergy Appl Immunol 1988;**85(2):**161-166

Basidiospore extracts: evidence for common antigenic/allergenic determinants.

O'Neil CE, Hughes JM, Butcher BT, Salvaggio JE, Lehrer SB

Spore extracts, prepared from Armillariella tabescens, Pleurotus ostreatus, Coprinus quadrifidus, Amanita muscaria, Ganoderma lucidum, Psilocybe cubensis, Pisolithus tinctorius, Scleroderma sp. and Calvatia cyathiformis, were examined for antigenic/allergenic relationships by Ouchterlony and radioallergosorbent testing (RAST) inhibition, respectively. Ouchterlony, using hyperimmunized rabbit sera, demonstrated a high degree of cross-antigenicity among the extracts tested; however, some unique antigens were also present. RAST inhibition, evaluated by comparing extract concentrations which inhibited the RAST by 50% (IC-50), varied with the allergen tested. P. cubensis was the most potent inhibitor (IC-50 ranged from 0.034 mg/ml for A. tabescens RAST to 0.29 mg/ml for G. lucidum RAST). P. tinctorius was the least potent inhibitor, failing to reach IC-50 at 10 mg/ml for any basidiospore extract. Evaluation of slopes and intercepts of the dose-response lines demonstrated qualitative and quantitative differences among allergens in these extracts. These results indicate the presence of shared allergenic epitopes, and suggest that representative extract panels could be developed for future use in diagnosis and treatment of basidiospore-sensitive individuals.

PMID: 2448249, UI: 88114101

J Ethnopharmacol 1987 Dec;**21(3):**297-305

Toxicologic and histopathologic studies of Pleurotus ostreatus mushroom in mice.

Al-Deen IH, Twaij HA, Al-Badr AA, Istarabadi TA

The edible mushroom Pleurotus ostreatus (with locally reported toxic properties) was identified and collected 1-4 days after raining in the city of Baghdad. It was freshly extracted with distilled water at room temperature. Both oral and intraperitoneal routes were used for acute and subacute toxicity studies on mice. In spite of important toxicologic signs and findings on treated animals, the estimated 24-h LD50 values exceeded 3 g/kg for both routes of administration. However, the 30-day LD50 values were 319 mg/kg for oral and 1143 mg/kg for i.p. administration. Gross examination of the dissected organs revealed marked haemorrhages in the intestine, liver, lung and the kidney. Histopathologic examination revealed significant changes mainly in the liver, which took the form of inflammation and microabscesses. The present results were consistent with clinical findings available after human and animal ingestion of this mushroom in Iraq.

PMID: 3441138, UI: 88156299

Appl Environ Microbiol 1987 Sep;**53(9):**2001-2008

Biodegradation of DDT [1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane] by the white rot fungus Phanerochaete chrysosporium.

Bumpus JA, Aust SD

Extensive biodegradation of 1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane (DDT) by the white rot fungus Phanerochaete chrysosporium was demonstrated by disappearance and mineralization of [14C]DDT in nutrient nitrogen-deficient cultures. Mass balance studies demonstrated the formation of polar and water-soluble

metabolites during degradation. Hexane-extractable metabolites identified by gas chromatography-mass spectrometry included 1,1,-dichloro-2,2-bis(4-chlorophenyl)ethane (DDD), 2,2,2-trichloro-1,1-bis(4-chlorophenyl)ethanol (dicofol), 2,2-dichloro-1,1-bis(4-chlorophenyl)ethanol (FW-152), and 4,4'-dichlorobenzophenone (DBP). DDD was the first metabolite observed; it appeared after 3 days of incubation and disappeared from culture upon continued incubation. This, as well as the fact that [14C]dicofol was mineralized, demonstrates that intermediates formed during DDT degradation are also metabolized. These results demonstrate that the pathway for DDT degradation in P. chrysosporium is clearly different from the major pathway proposed for microbial or environmental degradation of DDT. Like P. chrysosporium ME-446 and BKM-F-1767, the white rot fungi Pleurotus ostreatus, Phellinus weirii, and Polyporus versicolor also mineralized DDT.

PMID: 3674869, UI: 88048290

Clin Allergy 1987 May;**17(3):**191-198

Basidiospore allergens: determination of optimal extraction methods.

Liengswangwong V, Salvaggio JE, Lyon FL, Lehrer SB

Five methods were tested by RAST for allergen extraction from seven basidiospore species Armillaria tabescens, Chlorophyllum molybdites, Coprinus quadrifidus, Pleurotus ostreatus, Calvatia cyathiformis, Pisolithus tinctorius, and Scleroderma sp. With each basidiospore type, extracted allergen activity varied according to the method employed. In general, defatting of spores with ethyl ether, followed by homogenization in 0.125 M NH4HCO3 buffer, resulted in greatest allergen yield. In order to compare extracts from different isolates, batches of Pleurotus ostreatus spores obtained from different locations and over different time periods were analysed. Spores harvested from the same basidiomycete species in different areas varied in allergen (RAST) and protein (HPLC profile) content. The spores obtained from the same location over a 1-2 year period did not differ significantly. These results indicate that basidiospores can be stored for several years and that spore extracts from different locations can vary. These studies will help in the future to provide better characterized extracts for clinical studies.

PMID: 3608137, UI: 87274056

Int Arch Allergy Appl Immunol 1987;**84(1):**56-61

Antigenic/allergenic analysis of basidiomycete cap, mycelia, and spore extracts.

Weissman DN, Halmepuro L, Salvaggio JE, Lehrer SB

Since airborne basidiospores may be important inducers of respiratory allergy, extracts of spores, caps and mycelia from Pleurent of free lipids in wild and cultivated plant bodies, as well as in the surface and deep mycelium of the higher edible basidiomycete Pleurotus ostreatus (Fr.) Kummer--Oyster mushroom--was studied. By means of GL chromatography fatty acids with the number of C atoms from 8 to 20 were identified. In plant bodies and mycelium of the Oyster mushroom unsaturated fatty acids preveil; the main portion falls to oleic acid (up to 56%).

PMID: 6538968, UI: 84193743

J Nutr Sci Vitaminol (Tokyo) 1984 Feb;**30(1):**27-35

First evidence for the occurrence of N delta-acetyl-L-ornithine and

quantification of the free amino acids in the cultivated mushroom, Pleurotus ostreatus.

Oka Y, Ogawa T, Sasaoka K

The free amino acid profile of the fruiting bodies of Pleurotus ostreatus was studied in detail. The first evidence for the occurrence of N delta-acetyl-L-ornithine in the mushroom was presented, and 33 ninhydrin-positive compounds were determined, besides N delta-acetyl-L-ornithine. Alanine, glutamic acid, valine, glutamine, glycine and leucine were predominant protein amino acids occurring in the free form. As regards the non-protein amino acids, ornithine, gamma-aminobutyric acid, saccharopine, alpha-aminoadipic acid, ethanolamine, cystathionine, and N-(gamma-glutamyl)ethanolamine were mainly detected. The sum of the nitrogen of the three abundant amino acids, alanine, glutaThe preparations are able to oxidize mono- and diphenols with different substituents in o-, m- and p-positions to phenol hydroxyls as well as o- and p-phenylene diamines. A change in the orientation of substituents in the substrate molecule is followed by a change in the mechanism of its oxidation. The enzyme activity is determined by the type of substituents in the phenol molecule: electron-withdrawing groups impede and electron-releasing ones facilitate the substrate oxidation. The Hammett equation is shown to be applicable for description of monophenol oxidation. An explanation of high values of positive deviations from it in the case of halogen-substituted phenols is suggested. A conclusion is drawn that Km of enzymes for oxygen determined from the full kinetic curves of O2 uptake with phenol redundancy are kinetic constants depending on the substrate structure.

PMID: 3090755, UI: 86290697

Arch Latinoam Nutr 1986 Jun;**36(2):**345-350

[Effect of the inoculation of the comestible fungus Pleurotus ostreatus on the chemical composition and digestibility of barley straw].

[Article in Spanish]

Ortega Cerrilla ME, Can Acosta B, Herrera Patino F, Perez-Gil Romo F

The purpose of the present study was to determine whether incubation of the edible mushroom Pleurotus ostreatus in barley straw for 45 or 60 days, proved to be a means of increasing the nutritive value and digestibility of the straw for ruminant animals. In this respect, the following determinations were performed in untreated barley straw (control), and in incubated barley straw with the mushroom strain mentioned previously, for 45 or 60 days: pH, moisture, crude protein, ash, hemicellulose, cellulose, lignin, gross energy and in vitro digestibility of the dry matter. Results showed that crude protein percentage remained constant (p less than or equal to 0.05) in all treatments (means 2.67%), increasing the ash content of the straw incubated for 60 days. The hemicellulose and cellulose percentages diminished significantly (p less than or equal to 0.05) in the straw incubated for 45 or 60 days (16.74, 32.24, 17.43, 32.41% respectively) than in the control straw (24.54, 40.15%). The lignin percentages increased, although not significantly in the straw incubated for 45 or 60 days with respect to the control straw (8.36; 9.10, 9.06%, respectively). Energy values were lower for the straw incubated 45 or 60 days (2.70; 2.74 Kcal/g) than for the control straw (2.80 Kcal/g), without difference in the in vitro dry matter digestibility by incubating the straw for 45 or 60 days with Pleurotus ostreatus and the control (56.04; 52.65; 53.06% respectively). It is concluded that the Pleurotus ostreatus strain used in this study was unable to delignify the straw, because of its lack of fenoloxidases, enzymes which are necessary for lignin biodegradation.

PMID: 3484345, UI: 87325366

Int Arch Allergy Appl Immunol 1985;**77(1-2):**169-170

Basidiomycete allergy: what is the best source of antigen?

Lopez M, Butcher BT, Salvaggio JE, Olson JA, Reed MA, McCants ML, Lehrer SB

Skin prick test activity and antigenicity of extracts of in vitro growth of the Basidiomycete Pleurotus ostreatus (PO) were compared to extracts of spores from PO growing in the wild. Patients demonstrated significant differences in skin test reactivity to the PO extracts. Some reacted only to in vitro growth extracts, others only to the spore extracts and 1 patient to all extracts. Further studies analyzed antigens present in all extracts with rabbit antisera to PO. Common as well as unique antigens were present in the spore extracts as compared to those from in vitro preparations. The fact that spores contain unique antigens suggests that basidiospores may be the best source of relevant allergens for clinical studies.

PMID: 4008070, UI: 85233419

Prikl Biokhim Mikrobiol 1984 Mar;**20(2):**273-279

[Lipid content and fatty acid composition of the higher edible fungus--the oyster mushroom Pleurotus ostreatus (Fr.) Kummer].

[Article in Russian]

Solomko EF, Panchenko LP, Sil'chenkova RK

The content of free lipids in wild and cultivated plant bodies, as well as in the surface and deep mycelium of the higher edible basidiomycete Pleurotus ostreatus (Fr.) Kummer--Oyster mushroom--was studied. By means of GL chromatography fatty acids with the number of C atoms from 8 to 20 were identified. In plant bodies and mycelium of the Oyster mushroom unsaturated fatty acids preveil; the main portion falls to oleic acid (up to 56%).

PMID: 6538968, UI: 84193743

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First evidence for the occurrence of N delta-acetyl-L-ornithine and quantification of the free amino acids in the cultivated mushroom, Pleurotus ostreatus.

Oka Y, Ogawa T, Sasaoka K

The free amino acid profile of the fruiting bodies of Pleurotus ostreatus was studied in detail. The first evidence for the occurrence of N delta-acetyl-L-ornithine in the mushroom was presented, and 33 ninhydrin-positive compounds were determined, besides N delta-acetyl-L-ornithine. Alanine, glutamic acid, valine, glutamine, glycine and leucine were predominant protein amino acids occurring in the free form. As regards the non-protein amino acids, ornithine, gamma-aminobutyric acid, saccharopine, alpha-aminoadipic acid, ethanolamine, cystathionine, and N-(gamma-glutamyl)ethanolamine were mainly detected. The sum of the nitrogen of the three abundant amino acids, alanine, glutamic acid and ornithine, accounted for about 40% of the total nitrogen in the amino acid fraction.

PMID: 6539816, UI: 84242049

G Batteriol Virol Immunol 1983 Jul;**76(7-12):**200-206

Immunological study on the wall proteins of different fruiting portions in Pleurotus ostreatus (Jacq. ex Fr.) Kummer and Agaricus bisporus (Lge.) Sing.

Tedesco G, Marchi A, Gerola FM

Immunological techniques are useful to clarify the sistematic scheme utilized for mushrooms. By comparing the various fruiting portions, a different composition in protein was observed in the cell wall of spores, pileus and stipe. The differences were present both in Agaricus bisporus and in Pleurotus ostreatus. The results indicate that a well definite choice of the utilized portions is necessary for comparative studies. In the Basidiomycetes the meiospores represent the more useful development stage to carry out immunological comparisons.

PMID: 6442242, UI: 85155079

Nucleic Acids Res 1983 May 11;**11(9):**2871-2880

The nucleotide sequences of the 5S rRNAs of four mushrooms and their use in studying the phylogenetic position of basidiomycetes among the eukaryotes.

Huysmans E, Dams E, Vandenberghe A, De Wachter R

The nucleotide sequences of the 5 S ribosomal RNAs of the mushrooms Russula cyanoxantha, Pleurotus ostreatus, Agaricus edulis, and Auricularia auricula-judae were determined. The sequences fit in a universal five-helix secondary structure model for 5 S RNA. As in most other 5 S RNAs, some helical areas contain non-standard base pairs. A clustering method was used to reconstruct an evolutionary tree from 82 eukaryotic 5 S RNA sequences. It allows to make a choice between alternative systematic classifications for basidiomycetes and reveals that the fungal kingdom is highly polyphyletic.

PMID: 6856478, UI: 83220825

Acta Biochim Pol 1983;**30(3-4):**291-302

Aromatic ring cleavage of protocatechuic acid by the white-rot fungus Pleurotus ostreatus.

Wojtas-Wasilewska M, Trojanowski J, Luterek J

In Pleurotus ostreatus protocatechuic acid is degraded by protocatechuate 3,4-dioxygenase (protocatechuate: oxygen 3,4-oxidoreductase, EC 1.13.11.3) via "intradiol" cleavage of aromatic ring to form beta-carboxy-cis,cis-muconic acid. The enzyme was isolated from the mycelium induced with p-hydroxybenzoic acid. An about 460-fold purification of the enzyme was achieved by ammonium sulphate fractionation, and DEAE-cellulose and Sephadex G-200 chromatography. The enzyme was homogeneous on analytical electrophoresis under

non-denaturing conditions, whereas in the presence of sodium dodecyl sulphate several polypeptides of low molecular weight appeared additionally in trace amounts. Molecular weight of the enzyme, determined by gel filtration and electrophoresis was 200 000 and 205 000, respectively. The enzyme showed low substrate specificity, its pH optimum was 8.0 and Michaelis constant for protocatechuic acid was 14.2 microM.

PMID: 6673424, UI: 84174913

G Batteriol Virol Immunol 1981 Jul;**74(7-12):**267-274

[Basidiomycetes in relation to antibiosis. II. Antibiotic activity of mycelia and culture liquids].

[Article in Italian]

Bianco Coletto MA

The author relates the results of the antibiotic activity of mycelia and culture liquids of 34 Basidiomycetes, tested against Escherichia coli, Staphylococcus aureus, Bacillus subtilis and Candida albicans. The mycelium disc test and the cylinder plate method were used, employing for the latter culture liquids at different ages. The most active against the three bacterial species were Psathyra spadiceo-grisea, Fistulina hepatica and Fomes pinicola; against S. aureus and B. subtilis, Lentinus edodes and Psilocybe coprophila; Coprinus phlyctidosporus, Lepista amara, Pholiota nameko, Pleurotus ostreatus 774 and 779, Schizophyllum commune, Stropharia melanosperma, Boletus felleus, Polyporus Schweinitzii and Trametes pini 786 are active only against B. subtilis. Psathyra spadiceo-grisea and Lentinus edodes showed activity against Candida albicans as well. Comparison is made of activity results of the strains employed with the currently accepted data in the literature for the same species.

PMID: 6813176, UI: 83028291

Folia Microbiol (Praha) 1981;**26(2):**133-136

Effect of cultivation conditions on cellulase activity of higher fungi.

Ginterova A, Janotkova O, Findova L

Production of cellulases was followed in 4 cultures of higher fungi (Agrocybe cylindracea, Len tinus tigrinus, Pleurotus ostreatus, Ramaria formosa) cultivated on various substrates under different conditions. Stationary cultivation was more suitable than the submerged one. Addition of carboxymethy cellulose (CMC) was more suitable than addition of glucose. The cellulase activity in the presence of CMC was higher after a 12-d cultivation than after a 23-d period. Pine sawdust was most effective of all the substrates tested for the production of cellulases. Beech sawdust and wheat or rye straw were also useful. The addition of yeast autolyzate decreased the production of cellulases. A culture of L. tigrinud was the best producer.

PMID: 7262712, UI: 81262266

Folia Microbiol (Praha) 1981;**26(3):**228-231

Utilization of fat and degradation of cholesterol by Pleurotus spp.

Ginterova A, Janotkova O

Plant oil was found to stimulate the formation of biomass in Pleurotus ostreatus, P. ostreatus from Florida and P. cornucopiae. The highest increase of the delipidized dry substance was found in P. ostreatus. The supernatant after submerged fermentation contained active emulsifiers. Fruiting bodies and mycelium of P. ostreatus did not contain cholesterol. Cholesterol added to homogenates of the fruiting bodies was degraded in a temperature-dependent manner. Degradation of cholesterol in the fermentation medium was slower.

PMID: 7196867, UI: 82005484

Mikrobiol Zh 1980 Mar;**42(2):**185-190

[Effect of pH and temperature on the activity of the beta-1,4-glucan-4-glucanohydrolases of an exocellular enzymatic preparation isolated from Pleurotus ostreatus (Jaeguiner ex Fr.) Kummer K-69].

[Article in Russian]

Daniliak NI

PMID: 7189813, UI: 80209341

Folia Microbiol (Praha) 1980;**25(4):**332-336

The relationship between Pleurotus ostreatus and Aspergillus flavus and the production of aflatoxin.

Ginterova A, Polster M, Janotkova O

The relationship between Pleurotus ostreatus and Aspergillus flavus in common mixed culture on various substrates was investiaged. It was found that P. Ostreatus, similarly to some other higher fungi, can liquidate colonies of A. flavus. This fungus does not produce aflatoxin and chromatographically similar compounds. On straw, corn cobs, millet and wheat A. flavus produced aflatoxin after a 3-week cultivation. A subsequent cultivation of P. ostreatus led to detoxication of straw and corn cobs but millet and wheat were not detoxicated. Cultivation of P. osteatus in the presence of 40-100 micrograms of aflatoxin B1 per g substrate did not result in detoxication of the material even after 34 d but the results showed that the aflatoxin concentration decreased to about one-fourth of the added amount.

PMID: 7419131, UI: 81025156

Folia Microbiol (Praha) 1980;**25(4):**318-323

Cellulase activity of higher fungi.

Ginterova A, Janotkova O, Zemek J, Augustin J, Kuniak L

The method of liquefaction of gel from cross-linked cellulose was used for monitoring the cellulolytic activity of 114 cultures of higher fungi, 47 of which belonged to Pleurotus ostreatus. All cultures of P. ostreatus had a low activity. The highest cellulase activity, manifested by Piptoporus betulinus, was comparable with that of Tricloderma viride QM6a.

PMID: 7191386, UI: 81025153

Acta Microbiol Pol 1980;**29(4):**353-364

Biotransformation of sodium lignosulfonates of different molecular weights by the fungus Pleurotus ostreatus.

Wojtas-Wasilewska M, Trojanowski J, Luterek J

Fractions of sodium lignosulfonates (NaLS) of varied molecular weight, obtained by gel-permeation chromatography on Sephadex G-50, were exposed to microbiological degradation using liquid cultures of Pleurotus ostreatus. The intensity of transformation observed during 4 weeks of growth (based on nitroso determinations) was inversely proportional to the molecular weight of the fractions studied. Degradation of lignosulfonates was accompanied by polymerization, particularly where low molecular weight fractions were involved. The activity of p-diphenol oxidase (laccase) was stimulated by the presence of lignosulfonates. This effect was especially noticeable in the case of high molecular weight components.

PMID: 6164255, UI: 81180655

Biochem Soc Trans 1979 Dec;**7(6):**1293-1295

Pleurotus ostreatus: a nitrogen-fixing fungus?

Ginterova A, Gallon JR

PMID: 575337, UI: 80134913

Biochim Biophys Acta 1979 Jul 4;**585(3):**451-461

A cytolytic protein from the edible mushroom, Pleurotus ostreatus.

Bernheimer AW, Avigad LS

Aqueous extracts of the edible mushroom, Pleurotus ostreatus, contain a substance that is lytic in vitro for mammalian erythrocytes. The hemolytic agent, pleurotolysin, was purified to homogeneity and found to be a protein lacking seven of the amino acids commonly found in proteins. In the presence of sodium dodecyl sulfate it exists a monomers of molecular weight 12 050 whereas under non-dissociating conditions it appears to exist as dimers. It is isoelectric at about pH 6.4. The sensitivity of erythrocytes from different animals correlates with sphingomyelin content of the erythrocyte membranes. Sheep erythrocyte membranes inhibit pleurotolysin-induced hemolysis and the inhibition is time and temperature dependent. Ability of membranes to inhibit hemolysis is abolished by prior treatment of membranes with specific phospholipases. Pleurotolysin-induced hemolysis is inhibited by liposomes prepared from cholesterol, dicetyl phosphate and sphingomyelin derived from sheep erythrocytes whereas a variety of other lipid preparations fail to inhibit. It is concluded that sphingomyelin plays a key role in the hemolytic reaction.

PMID: 573629, UI: 80021211

Folia Microbiol (Praha) 1978;**23(4):**292-298

Glucose-2-oxidase activity and accumulation of D-arabino-2-hexosulose in cultures of the basidiomycete Oudemansiella mucida.

Volc J, Sedmera P, Musilek V

Submerged cultures of the basidiomycete Oudemansiella mucida, strain III, accumulate D-arabino-2-hexosulose. The maximum yields during cultivations in shaker flasks or in a laboratory fermentor are 6--12 and 15 mg/ml, respectively (20--50% conversion of substrate glucose). The accumulation is transient, the aldoketose being again utilized after glucose exhaustion. Its production is stimulated by fluoride ions. The enzyme responsible for the C(2)-specific oxidation of D-glucose acts as an intracellular oxidase with a maximum activity in the exponential phase of growth. D-arabino-2-Hexosulose was also detected in the cultivation medium of the wood-rotting fungi Pleurotus ostreatus, Laetiporus sulphureus, and Phellinus abietis.

PMID: 689573, UI: 79004423

Zentralbl Bakteriol [Naturwiss] 1978;**133(7-8):**619-622

Production of protein by fungi from agricultural wastes. VI. Quality of the protein formed in Rhizoctonia melongina, Pleurotus ostreatus, and Coprinus aratus.

Jauhri KS

The amino acid content of the three fungi, viz., Rhizoctonia melongina, Pleurotus ostreatus, and Coprinus aratus, grown in liquid media (JAUHRI and SEN 1978d) containing agricultural wastes (sugarcane bagasse for the former two and wheat straw for the latter), were analysed qualitatively. Amino acid fraction of the three fungi, determined through paper chromatography, contained all the 8 essential amino acids in addition to 9 odd amino acids, except in the case of Rhizoctonia melongina in which the essential amino acid lysine was lacking. The possibilities for mass production and the use of these three fungi in dietetics are further discussed in this paper.

PMID: 571184, UI: 79161528

Zentralbl Bakteriol [Naturwiss] 1978;**133(7-8):**614-618

Production of protein by fungi from agricultural wastes. V. Effect of various organic acids and growth promoters on the efficiency of substrate utilization and protein production by Rhizoctonia melongina, Pleurotus ostreatus, and Coprinus aratus.

Jauhri KS, Sen A

Results of an investigation made for selecting a source of organic acid and also a growth promoter that can maximize protein production in the three test fungi, viz., Rhizoctonia melongina, Pleurotus ostreatus, and Coprinus aratus from their respective substrates (i.e. sugarcane bagasse for the former two and wheat straw for the latter) are reported. Among organic acids, acetic acid (at 0.1% level) and among the growth promoters ascorbic acid (at 0.1% level) had maximum influence on growth and protein production. Based on the detailed investigations carried out with three test fungi (JAUHRI at. al. 1978, Jauhri and Sen 1978a, b, c, new stuffed media have been formulated for

the three test fungi which assure maximum protein efficiency from them.

PMID: 571183, UI: 79161527

Zentralbl Bakteriol [Naturwiss] 1978;**133(7-8):**609-613

Production of protein by fungi from agricultural wastes. IV. Effect of certain inorganic salts on the efficiency of substrate utilization and protein production by Rhizoctonia melongina, Pleurotus ostreatus, and Coprinus aratus.

Jauhri KS, Sen A

The paper deals with the standardization of the concentrations of magnesium sulphate, zinc sulphate, and ferric chloride in the medium containing sugarcane bagasse (for Rhizoctonia melongina and Pleurotus ostreatus) and wheat straw (for Coprinus aratus) for achieving maximum protein production.

PMID: 571182, UI: 79161526

Zentralbl Bakteriol [Naturwiss] 1978;**133(7-8):**604-608

Production of protein by fungi from agricultural wastes. III. Effect of phosphorus on the efficiency of substrate utilization and protein production by Rhizoctonia melongina, Pleurotus ostreatus, and Coprinus aratus.

Jauhri KS, Sen A

An attempt was made to select a source of phosphorus that is readily available and ensures maximum protein efficiency for Rhizoctonia melongina, Pleurotus ostreatus, and Coprinus aratus, using sugarcane bagasse for the former two and wheat straw for the latter one in the liquid medium. Of the six different phosphorus compounds tested, urea phosphate was unanimously preferred by the three fungi. The concentration of urea phosphate for maximum protein output was then standardized.

PMID: 571181, UI: 79161525

Zentralbl Bakteriol [Naturwiss] 1978;**133(7-8):**597-603

Production of protein by fungi from agricultural wastes. II. Effect of carbon/nitrogen ratio on the efficiency of substrate utilization and protein production by Rhizoctonia melongina, Pleurotus ostreatus, and Coprinus aratus.

Jauhri KS, Sen A

An attempt was made to standardize the C/N ratio at which maximum protein production may be achieved by Rhizoctonia melongina, Pleurotus ostreatus, and Coprinus aratus, using sugarcane bagasse for the former two and wheat straw for the latter in the liquid medium. Three different ways of changing the C/N ratios were tried. The optimum levels of carbon and nitrogen required for the best yield, substrate utilization, and protein production efficiency were worked out.

PMID: 571180, UI: 79161524

Zentralbl Bakteriol [Naturwiss] 1978;**133(5):**464-467

[Influence of sulphur dioxide on the growth of some fungal species].

[Article in German]

Mejstrik V

The paper presents results of experiments with fumigation of different concentrations of SO2 on Flamulina velutipes, Nematoloma fasciculare, and Pleurotus ostreatus. All the three concentrations of SO2, 84, 168, and 1.680 microgram/m3, had inhibitory effect on the growth of the fungi species. The inhibitory effect on the growth of the fungi species. The inhibitory effect increased with increasing SO2 concentration. All the three fungial species were prevented from growing by the concentration of 1.680 microgram/m3 SO2. Any changes in morphological structure of hyphae, were not observed.

PMID: 569409, UI: 79079182

Folia Microbiol (Praha) 1978;**23(1):**55-59

Exogenous regulators in the mycelium of Pleurotus ostreatus after exogenous application.

Vinklarkova K, Sladky Z

The mycelium of the fungus Pleurotus ostreatus was cultured on a synthetic medium with growth regulators. Best growth was observed on media with 100 ppm IAA, 200 ppm GA3 and 200 ppm of kinetin. Growth of terminal hyphae and the appearance of colonies differed characteristically. Auxin bio-assays showed that the content of substances in younger mycelium slowly increased during cultivation without conspicuous changes in the medium. After exogenous application of IAA the content of auxins in younger mycelium increased and the content of IAA decreased gradually in the culture medium. Gibberellin bio-assays showed their content in the mycelium fell during cultivation and while it increased in the medium. Application of GA3 to the medium leads to a significant increase in these substances in the young mycelium and in the medium their level remains the same. Cytokinin bio-assays showed their content to vary during cultivation. An addition to kinetin to the nutrient medium results in an increase of cytokinins in the mycelium while in the medium the level of cytokinins is maintained. Addition of one substance thus influences the levels of other endogenous regulators.

PMID: 564319, UI: 78108034

Acta Biochim Pol 1978;**25(4):**369-378

Induction of laccase in Basidiomycetes: apparent activity of the inducible

and constitutive forms of the enzyme with phenolic substrates.

Leonowicz A, Trojanowski J, Orlicz B

The purified preparations of the inducible and constitutive forms of laccase (EC 1.14.18.1) have been obtained from mycelia of Trametes versicolor, Pleurotus ostreatus and Pholiota mutabilis. The activities of the inducible forms of laccase with ferulic acid and other phenolic hydrogen donors were found to be several-fold higher as compared with the constitutive forms.

PMID: 108885, UI: 79184089

Acta Biochim Pol 1978;**25(2):**147-156

Induction of laccase in Basidiomycetes: the laccase-coding messenger.

Leonowicz A, Trojanowski J

Formation of the mRNA specific for the inducible forms of laccase was evidenced in Coriolus versicolor, Pleurotus ostreatus and Pholiota mutabilis. The half-life time of these mRNAs in the fungi species studied were, respectively, 30, 37 and 24 min. Molecular weight of the newly synthesized mRNA in Pleurotus ostreatus was about 4.5X10(5), consistently with the size of the inducible laccase protein. The polysome obtained from the ferulic acid-treated mycelium, synthesized in vitro a polypeptide with the electrophoretic mobility similar to that of laccase.

PMID: 103348, UI: 79079318

Zentralbl Bakteriol [Naturwiss] 1978;**133(7-8):**588-596

Production of protein by fungi from agricultural wastes. I. Standardization of certain factors for maximum protein production.

Jauhri KS, Kumari ML, Sen A

Several fungi were screened for protein production in a simple medium using either sugarcane bagasse, wheat straw or cowdung as substrate. Out of them Rhizoctonia melongina, Pleurotus ostreatus, and Coprinus aratus proved promising and were taken up for further studies. Optimum conditions of temperature, incubation, and pH for maximum growth and protein production by the three fungi were then ascertained and standardized.

PMID: 34947, UI: 79161523

Appl Environ Microbiol 1977 Apr;**33(4):**871-873

Exponential growth kinetics for Polyporus versicolor and Pleurotus ostreatus in submerged culture.

Carroad PA, Wilde CR

Simple mathematical models for a batch culture of pellet-forming fungi in submerged culture were tested on growth data for Polyporus versicolor (ATCC 12679) and Pleurotus ostreatus (ATCC 9415). A kinetic model based on a

growth rate proportional to the two-thirds power of the cell mass was shown to be satisfactory. A model based on a growth rate directly proportional to the cell mass fitted the data equally well, however, and may be preferable because of mathematical simplicity.

PMID: 559472, UI: 77200569

FEBS Lett 1976 Sep 15;**68(1):**15-18

A 13C nuclear magnetic resonance study of a gel-forming branched (1 leads to 3)-beta-D-glucan, A3, from Pleurotus ostreatus (Fr.) Quel: determination of side-chains and conformation of the polymer-chain in relation to gel-structure.

Saito H, Ohki T, Yoshioka Y, Fukuoka F

PMID: 986954, UI: 77003701

Dtsch Med Wochenschr 1976 Aug 20;**101(34):**1241-1245

[Mushroom worker's lung caused by inhalation of spores of the edible fungus pleurotus Florida].

[Article in German]

Noster U, Hausen BM, Felten G, Schulz KH

A new edible mushroom, known as oyster mushroom (Pleutrotus Florida, variety of Pleurotus ostreatus) has recently gained commercial importance in Europe, having been imported from the U.S.A. in 1963 and cultivated in Germany between 1972 and 1973. Several persons concerned with the cultivation and industrial production of this mushroom fell ill, after close contact with it over a period of some months, with exhaustion, headache, chills and fever, and cough. These symptoms, similar to those of "farmer's lung" were proved to be caused by the spores of Pleurotus Florida, inhaled in harvesting rooms. The suspicion of an allergic disease, is supported by the history and clinical picture, and the demonstration of precipitating antibodies against spore extracts (Ouchterlony test). The antigens probably have a high molecular weight and are fixed to the spore membrane. Experimental sensitisation of rabbits also revealed precipitins. One of three isolated antigens produced antibodies identical in man and rabbit.

PMID: 820538, UI: 76235104

Z Lebensm Unters Forsch 1976 Apr 28;**160(4):**401-405

Studies on mushroom flavours. 3. Some flavour compounds in fresh, canned and dried edible mushrooms.

Dijkstra FY

The concentrations of 1-octen-3-ol, 5'-GMP and glutamic acid were compared in 8 fresh, 3 canned and 5 dried mushroom species. The highest amounts of 1-octen-3-ol and 5'-GMP were found in the fresh muschrooms.

Agaricus bitorquis, Pleurotus ostreatus and Pholiota squarrosa contained 5-7 times as much 1-octen-3-ol as Agaricus bisporus and Calvatia gigantea 58 times as much. Coprinus comatus and Pleurotus ostreatus contained much 5'-GMP. Little 1-octen-3-ol and 5'-GMP were found in most dried and canned mushrooms. Potatoes and tomatoes were analyzed for comparison. Little or no 1-octen-3-ol and 5'-GMP were observed. Glutamic acid was present in most samples in sufficient quantities to have an important influence on the flavour.

PMID: 987665, UI: 77018005

Carbohydr Res 1975 Sep;**43(2):**305-320

Isolation, purification, and structure of components from acidic polysaccharides of Pleurotus ostreatus (Fr.) Quel.

Yoshioka Y, Emori M, Ikekawa T, Fukuoka F

Isolation of an antitumor component from polysaccharide fraction A5 of some Basidiomyces was achieved by column chromatography on Sephadex G-200. A detection method based on the specific rotatory characteristics of the polysaccharide was applied to estimate components in effluent fractions from the chromatography, and it was confirmed that a series of eluates having similar specific rotation was made up of homogeneous polysaccharide. Three components (H51, H52, and H53) were isolated, in chromatographically pure state, from fraction A5. Component H51 consisted of a skeleton of beta-(1 leads to 3)-linked glucose residues, probably having branches of galactose and mannose residues, and also containing acidic sugars. Component H53 had a main structure similarly consisting of beta-(1 leads to 3)-linked glucose residues and a larger proportion of acidic sugar than H51. Component H52 was a heteropolysaccharide made up of alpha-linked galactose and mannose residues. Components H51 and H53 had a higher and a lower molecular weight, respectively, than H52. The only antitumor-active component was H51.

PMID: 1192437, UI: 76064193

Prikl Biokhim Mikrobiol 1975 Jul;**11(4):**535-538

[Study of oxidative enzymes of the lignin-degrading fungus Pleurotus ostreatus].

[Article in Russian]

Ulezlo IV, Uporova TM, Feniksova RV

The elctrophoretic separation in polyacrylamide gel of laccase and peroxidase isoenzymes of the lignin-degrading fungus Pleurotus ostreatus was investigated. The optimal electrophoretic conditions were found: in the electrode buffer tris-diethyl barbituric acid pH 7.0 in the gradient gel-4-10% acrylamide. Seven peroxidase isoenzymes oxidizing base benzidine and guaiacol were identified and five laccase isoenzymes reacting with specific substrates-p-phenylene diamine, alphs-naphthol, pyrogallol, hydroquinone were determined.

PMID: 813202, UI: 76102526

Mikrobiol Zh 1975 Mar;**37(2):**181-184

[Growth of mycelium of Pleurotus ostreatus (Fr.) Kummer in pure

culture].

[Article in Ukrainian]

Bukhalo AS, Parkhomenko LP, Martinenko MM

PMID: 1240577, UI: 76125334

Acta Microbiol Pol [B] 1975;**7(2):**77-90

Studies on the decomposition of lignosulfonates by the fungi Pleurotus ostreatus and Trametes pubescens.

Wojtas-Wasilewska M, Trojanowski J

The fungi Pleurotus ostreatus and Trametes pubescens were grown in a mineral medium containing 1% of glucose and 0.9% of lignosulfonates introduced into the culture medium in the form of yeast waste liquor. Chromatography of extracts of the medium and determinations of sulphur and lignosulfonates have revealed that the fungi studied utilized the constituents of the yeast waste liquor (lignosulfonates) as carbon source. This was manifested in an increase of dry mass of the mycelium and protein as compared with the control. The constituents of the yeast waste liquor were also found to have a stimulating effect on the formation of both exo-and endoenzymes, laccase and peroxidase. This may indicate that these oxidases take part in the decomposition of lignosulfonates.

PMID: 1172650, UI: 76037134

Folia Microbiol (Praha) 1975;**20(3):**246-250

The balance of nitrogen and composition of proteins in Pleurotus ostreatus grown on natural substrates.

Ginterova A, MAXIANOVA A

The balance of nitrogen and nitrogen compounds in Pleurotus ostreatus, cultivated on waste materials, corn straw and maize residues, was investigated. The results show that this organism has a considerable ability to fix atmospheric nitrogen, fixing 312 g of total nitrogen per 100 kg dry weight. When recalculating with respect to a decrease of the substrate during growth of the organism a value of 9.7 mg per 1 g of the decrease in material is obtained. Fruiting bodies, as well as the produced substrate contain 17-19 amino acids. In the produced substrate the content of the protein nitrogen represents only 30% of the total. It can concluded that Pleurotus ostreatus yields a suitable raw material in the food industry and possibly also a fodder based on the basis of solid, cellulose-containing wastes.

PMID: 1170126, UI: 75188215

Vox Sang 1975;**29(3):**221-227

On the specificity of mushroom Pleurotus ostreatus and Pleurotus spodoleucus extracts.

Kogure T

Extracts of mushrooms Pleurotus ostreatus and Pleurotus spodoleucus contain hemagglutinins with anti-H specificity similar to those found in Cytisus sessilifolius and Laburnum alpinum.

PMID: 1169858, UI: 75180016

Arch Mikrobiol 1973;**88(2):**111-118

[Aminopeptidases of basidiomycetes. II. Comparison of substrate specificities: (proline)iminopeptidase and (leucine)aminopeptidase of Hapalopilus nidulans--aminopeptidase 53 of Pleurotus ostreatus].

[Article in German]

Blaich R

PMID: 4734281, UI: 73083690

Microbios 1972 Aug;**6(21):**23-28

Ferulic acid as the inductor of messenger RNA synthesis related to laccase formation in the wood rotting fungus Pleurotus ostreatus.

Leonowicz A, Trojanowski J, Nowak G

PMID: 4206471, UI: 74129362

Mycologia 1969 Nov;**61(6):**1041-1047

Enzymatic activities during basidiocarp development of Pleurotus ostreatus.

Michalski CJ, Beneke ES

PMID: 5393104, UI: 70153119

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13 citations found

Chem Pharm Bull (Tokyo) 1994 Mar;**42(3):**530-533

Studies on active substances in herbs used for hair treatment. I. Effects of herb extracts on hair growth and isolation of an active substance from Polyporus umbellatus F.

Inaoka Y, Shakuya A, Fukazawa H, Ishida H, Nukaya H, Tsuji K, Kuroda H, Okada M, Fukushima M, Kosuge T

The effects of methanol extracts of 80 herbs on hair growth were investigated, using normal C3H/He mice from which telogen hair on the back had been removed. Eighteen of the extracts apparently promoted hair regrowth on the mice. As one of active principles in Polyporus umbellatus F., 3,4-dihydroxybenzaldehyde was isolated by column chromatography on Amberlite XAD-2, Sephadex LH-20 and silica gel.

PMID: 8004697, UI: 94273215

Am J Chin Med 1994;**22(1):**19-28

Combined effects of chuling (Polyporus umbellatus) extract and mitomycin C on experimental liver cancer.

You JS, Hau DM, Chen KT, Huang HF

Chuling (Polyporus umbellatus), one of the commonly used Chinese medical herbs, was combined with mitomycin C and then studied against intrahepatic implantation of sarcoma 180 tumor cells in mice. Oral administration of chuling extract, intraperitoneal injection of mitomycin C and the combination of both increased the life span of tumor-bearing mice 71.6%, 70.1% and 119.9%, respectively. The same treatments were found to be cytotoxic to Sarcoma-180-induced liver tumor cells. The synthetic rates of DNA, RNA and protein were all inhibited measurably by the combined treatment. Histopathological studies showed that lymphocytes infiltrated and surrounded the cancer cells, and there was some fibrosis found in normal cells and cancer cells. These results indicate the potential use of chuling as an anticancer agent.

PMID: 8030616, UI: 94303647

Chin Med Sci J 1993 Sep;**8(3):**134-138

Immunosuppression in murine brucellosis.

Zhang J, Gao B, Cun C, Lu X, Wang H, Chen X, Tang L

Brucellosis in mice results in a distinct immunosuppression which may be abrogated by immunomodulators, such as levamisole, bestatin, interleukin-2 (IL-2) and Polyporus umbellatus. The data presented here provide evidence that immunosuppression in addition to infection of target tissues and allergic reactions (including types 3 and 4) contributes to the pathogenesis of brucellosis. The present study also provides some basic data regarding the value of this animal model, and criteria for observing the effect of therapy on chronic brucellosis.

PMID: 8142626, UI: 94191221

Chung Kuo Chung Hsi I Chieh Ho Tsa Chih 1993 Sep;**13(9):**533-535

[Therapeutic effect of combined therapy of Salvia miltiorrhizae and Polyporus umbellatus polysaccharide in the treatment of chronic hepatitis B].

[Article in Chinese]

Xiong LL

90 patients of chronic hepatitis B with positive HBV replication markers and abnormality of ALT were randomly allocated to 3 groups. 30 cases were treated with Salvia miltiorrhizae (SM) and Polyporus Umbellatus polysaccharide (PUP) as group I, 30 cases were treated with SM solely as group II and 30 cases were treated with PUP only as group III. By the end of 3 months in the treatment course, normalization rate of ALT were 80.0%, 40.0% and 53.3% and the negative conversion rate of HBeAg were 56.7%, 50.0% and 16.7% in the group I, II and III respectively. Follow up for 3 months after the end of therapy, ALT level was normal in 82.6%, 42.7% and 59.1% respectively. HBeAg was negative in 60.9%, 52.4% and 22.7%. Follow up for 9 months after the end of the treatment, ALT was normal in 83.3%, 43.8% and 56.3%. HBeAg was negative in 66.7%, 56.3% and 25.0% respectively. These results showed that combined therapy with SM and PUP might be more potent than SM and PUP therapy alone.

Publication Types:

- Clinical trial
- Randomized controlled trial

PMID: 8111209, UI: 94154474

Chung Kuo Chung Hsi I Chieh Ho Tsa Chih 1992 Sep;**12(9):**533-534

[Clinical study of rapid bladder filling agent].

[Article in Chinese]

Li QD, Wang SQ, Sun CM

The Rapid Bladder Filling Agent (RBFA) was prepared with Polyporus umbellatus, Poria cocos and Furosemidum. The urinary volume and the best filling time of urinary bladder were observed with ultrasonography in 211 cases. The result showed that in experimental group the largest urinary volume in unit time was more than that in control group and shortest filling time was shorter (30.35 +/- 7.9 min) in comparing with control group (145.6 +/- 50.1

min). Clinical observation for 1180 cases proved that the RBFA had the effects of raising the quality of ultrasonographic examination and escalating work efficiency, shortening the waiting time of patients and relieving patients' suffering from excessive filling of urinary bladder. The effective time of the RBFA was fast but the duration was short. The RBFA had no adverse effect.

PMID: 1298469, UI: 93222639

Chung Kuo I Hsueh Ko Hsueh Yuan Hsueh Pao 1992 Jun;**14(3):**168-172

[A study on the role of immunosuppression in the pathogenesis of brucellosis].

[Article in Chinese]

Zhang J

An immunosuppressive effect was seen in murine brucellosis as detected by using plaque forming cell (PFC) and 3H-labelled lymphocyte blastogenesis transformation (LBT) assays. The immunosuppression PFC could last until 11 months after infection, while that of LBT was only seen at 3 months after infection. This immunosuppression could be relieved by using immunomodulators such as levamisole, bestatin, IL-2 and polyporus umbellatus. IL-2 and polyporus umbellatus could reverse the suppression to normal levels. Thus, this study provided evidence that immunosuppression is a component of pathogenesis of brucellosis.

PMID: 1394733, UI: 93008602

Chem Pharm Bull (Tokyo) 1992 Jan;**40(1):**143-147

Studies on constituents of fruit body of Polyporus umbellatus and their cytotoxic activity.

Ohsawa T, Yukawa M, Takao C, Murayama M, Bando H

From the crude drug Chorei, the fruit body of Polyporus umbellatus, seven new components named polyporusterone A, B, C, D, E, F and G, were isolated and their structures were determined on the basis of the spectral data. These compounds showed cytotoxic action on leukemia 1210 cell proliferation.

PMID: 1576664, UI: 92248738

Chung Hsi I Chieh Ho Tsa Chih 1991 Apr;**11(4):**225-226

[Effect of Polyporus umbellatus polysaccharide on function of macrophages in the peritoneal cavities of mice with liver lesions].

[Article in Chinese]

Zhang YH, Liu YL, Yan SC

The cells in peritoneal cavities of mice were taken out and cultured in vitro. The amount to release H2O2 of the

macrophages was assayed by fluorimetry. Polyporus umbellatus polysaccharide (PUP) could not only increase the number of macrophages and the amount of H2O2 release in the peritoneal cavities of normal mice, but also raise the lowered number of macrophages and the ability to release H2O2 in the peritoneal cavities of the mice with liver lesions caused by CCl4 significantly. So PUP could improve the cellular immunity of normal mice and the mice with liver lesions.

PMID: 1773459, UI: 92127650

Chung Yao Tung Pao 1988 Sep;**13(9):**32-33

[Determination of the components and molar ratio of the polysaccharide from a fermentation solution of Polyporus umbellatus (Pers.) Fr].

[Article in Chinese]

Zhu P

PMID: 3219763, UI: 89119648

Chung Kuo Yao Li Hsueh Pao 1988 Jul;**9(4):**345-348

[Protective effect of Polyporus umbellatus polysaccharide on toxic hepatitis in mice].

[Article in Chinese]

Lin YF, Wu GL

PMID: 3195347, UI: 89059843

Chung Hsi I Chieh Ho Tsa Chih 1988 Mar;**8(3):**141-143

[Clinical and experimental research on Polyporus umbellatus polysaccharide in the treatment of chronic viral hepatitis].

[Article in Chinese]

Yan SC

PMID: 3416393, UI: 88327960

Chung Kuo Yao Li Hsueh Pao 1983 Jun;**4(2):**141-143

[Effects of Polyporus umbellatus polysaccharides on glycogen storage, enzyme activities in glyconeogenesis and glycogenolysis of liver in mice bearing hepatoma H22].

[Article in Chinese]

Wei Q, Wu GL, Nie JC

PMID: 6310956, UI: 83305008

Chung Kuo Yao Li Hsueh Pao 1983 Mar;**4(1):**52-54

[Effects of Polyporus umbellatus polysaccharides on liver carbohydrate metabolism and adrenocortical function of mice bearing hepatoma H22].

[Article in Chinese]

Wei Q, Wu GL, Nie JC, Song SY, Bai YZ

PMID: 6223500, UI: 83252272

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17 citations found

J Biol Chem 1991 Nov 5;**266(31):**21014-21017

An investigation on the quinoprotein nature of some fungal and plant oxidoreductases.

Maccarrone M, Veldink GA, Vliegenthart JF

The presence of pyrroloquinoline quinone (PQQ) as the organic cofactor of Dactylium dendroides galactose oxidase and lentil (Lens culinaris) seedling amine oxidase, purported PQQ-containing oxidoreductases (Van der Meer, R. A., Jongejan, J. A., and Duine, J. A. (1989) J. Biol. Chem. 264, 7792-7794; Citro, G., Verdina, A., Galati, R., Floris, G., Sabatini, S., and Finazzi-Argo', A. (1989) FEBS Lett. 247, 201-204), was reinvestigated using the nitro blue tetrazolium redoxcycling method (Paz, M. A., Gallop, P. M., Torrelio, B. M., and Fluckiger, R. (1988) Biochem. Biophys. Res. Commun. 154, 1330-1337; Paz, M. A., Fluckiger, R., Boak, A., Kagan, H. M., and Gallop, P. M. (1991) J. Biol. Chem. 266, 689-692) and the enzyme-linked immunosorbent assay with polyclonal antibodies against PQQ. The possible quinoprotein nature of the laccases from Polyporus versicolor and Rhus vernicifera was also investigated because of the similarities in spectroscopic and kinetic features of these enzymes and the laccase from Phlebia radiata, reported to be a PQQ protein (Karhunen, E., Niku-Paavola, M.-L., Viikari, L., Haltia, T., Van der Meer, R. A., and Duine, J. A. (1990) FEBS Lett. 267, 6-8). The presence of a quinonoid cofactor in lentil seedling amine oxidase is confirmed, whereas galactose oxidase and both laccases do not display any quinoprotein nature.

PMID: 1657943, UI: 92041970

Biochem J 1988 Jul 15;**253(2):**561-568

Type 2-depleted fungal laccase.

Hanna PM, McMillin DR, Pasenkiewicz-Gierula M, Antholine WE, Reinhammar B

Although copper is quantitatively removed from fungal laccase (Polyporus versicolor) by extended dialysis against high concentrations of cyanide, we have been unable to reconstitute the protein by addition of Cu(I) ions. However, two new methods for reversibly removing the type 2 Cu centre have been developed. The visible absorption at 610 nm, which is attributable to type 1 Cu, is unaffected by the procedure, but the absorbance of the type 3 Cu at 330 nm is decreased by 60 +/- 10%. The decrease is due, at least in part, to partial reduction of the binuclear type 3 centre, although there may be some change in the molar absorptivity of the oxidized chromophore as well. The change in the c.d. spectrum that occurs at approx. 350 nm may be explained in the same way, but it may also reflect the loss of a signal due to the type 2 Cu. Upon removal of the type 2 Cu an absorbance increase appears at approx. 435 nm, and it is assigned to the semi-reduced form of the type 3 pair. In the e.p.r. spectrum of the type 2-depleted enzyme the type 1 Cu signal exhibits well-resolved ligand hyperfine splitting, which can be simulated on the basis of contributions from two N and two H nuclei (AH congruent to AN congruent to 25 MHz).

The H atoms are assumed to be attached to the beta-carbon of the covalently bonded cysteine ligand. A signal from a semi-reduced form(s) of the type 3 site can also be resolved in the spectrum of the type 2-depleted enzyme, and on the basis of the second integral of the e.p.r. spectrum 40% of the type 3 pairs are believed to be in a partially reduced state. The semi-reduced type 3 site is remarkably stable and is not readily oxidized by H2O2 or IrCl6(2-) or reduced by Fe(CN)6(4-). Intramolecular electron transfer is apparently quite slow in at least some forms of the type 2-depleted enzyme, and this may explain why the activity is at best 5% of that of the native enzyme. Full activity returns when type 2 copper is restored.

PMID: 2845923, UI: 89025593

Appl Environ Microbiol 1987 Sep;**53(9):**2001-2008

Biodegradation of DDT [1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane] by the white rot fungus Phanerochaete chrysosporium.

Bumpus JA, Aust SD

Extensive biodegradation of 1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane (DDT) by the white rot fungus Phanerochaete chrysosporium was demonstrated by disappearance and mineralization of [14C]DDT in nutrient nitrogen-deficient cultures. Mass balance studies demonstrated the formation of polar and water-soluble metabolites during degradation. Hexane-extractable metabolites identified by gas chromatography-mass spectrometry included 1,1,-dichloro-2,2-bis(4-chlorophenyl)ethane (DDD), 2,2,2-trichloro-1,1-bis(4-chlorophenyl)ethanol (dicofol), 2,2-dichloro-1,1-bis(4-chlorophenyl)ethanol (FW-152), and 4,4'-dichlorobenzophenone (DBP). DDD was the first metabolite observed; it appeared after 3 days of incubation and disappeared from culture upon continued incubation. This, as well as the fact that [14C]dicofol was mineralized, demonstrates that intermediates formed during DDT degradation are also metabolized. These results demonstrate that the pathway for DDT degradation in P. chrysosporium is clearly different from the major pathway proposed for microbial or environmental degradation of DDT. Like P. chrysosporium ME-446 and BKM-F-1767, the white rot fungi Pleurotus ostreatus, Phellinus weirii, and Polyporus versicolor also mineralized DDT.

PMID: 3674869, UI: 88048290

Can J Microbiol 1983 Apr;**29(4):**457-463

Investigation of white-rot fungi for the conversion of poplar into a potential feedstuff for ruminants.

Reade AE, McQueen RE

Five isolates of wood-rotting fungi were compared for their ability to increase the digestibility of poplar shavings. Homogenates of the fungi were inoculated into mixtures of 25 g of shavings and 100 mL of supplementary nutrient solution and incubated at 25 degrees C. The in vitro rumen digestibility of the products increased from 30% at the start of the fermentation to maxima of 72% with Polyporus anceps after 8 weeks, 64% with Ganoderma applanatum and 62% with Phanerochaete chrysosporium after 4 weeks, 61% with Polyporus versicolor after 3 weeks, and 42% with Fomitopsis ulmarius after 4 weeks. Fibre analysis showed a decrease in lignin as digestibility increased. Loss of carbohydrates occurred in all fermentations and continued after lignin loss ceased. Dry matter yield at the time of maximum digestibility ranged from 80 to 94% of the original dry matter. The highest digestibilities attained were similar to those of conventional roughage feeds for ruminants. This shows that this fermentation could form the basis of a practical system for converting poplar into a feedstuff.

PMID: 6850424, UI: 83206228

Biophys Chem 1982 Jun;**15(3):**177-190

Radical scavenging and electron-transfer reactions in Polyporus versicolor laccase a pulse radiolysis study.

Guissani A, Henry Y, Gilles L

The interaction of the radicals OH, t-BuO, Eaq, CO2 and O2 with the copper oxidase, laccase, from Polyporus, has been studied by the pulse-radiolysis technique. Each of these radicals formed transient adducts with a broad absorption maximum around 310 nm. Analysis of the optical properties and of the very fast rates of formation of these compounds shows that each radical interacts with a limited number of sites on the polypeptide part of the protein amongst R-S-S-R, histidine and aromatic residues. Interaction with the carbonyl group of some of the peptides bonds is also possible. The few target sites are probably hit simultaneously and electron transfer between these sites may also occur. In all cases, ina subsequent step, intramolecular electron transfer from the polypeptide radical adducts leads to a partial reduction of the blue type-1 Cu2+ with rates varying between 10(3) adn 10(4) s-1. Further reduction of the type-1 CU2+ occurs through a slow intermolecular reaction between two laccase radical transient adducts. In the case of CO2 and O2, this slow reduction could alternatively be due to an intermolecular reaction between laccase and CO2 or O2. The oxidation radicals OH, Br2 and (SCN)2, which formed radical adducts with fully ascorbate-reduced laccase, did not induce any type-1 copper reoxidation.

PMID: 6286003, UI: 82257653

Biokhimiia 1981 Sep;**46(9):**1694-1702

[Inhibition mechanism of Polyporus versicolor laccase by halide ions].

[Article in Russian]

Ali Naki, Varfolomeev SD

A kinetic study of inhibition of Polyporus versicolor laccase activity by fluoride-, chloride- and bromide ions has been carried out. It has been found that the fluoride ion is a non-competitive inhibitor with respect to the electron donor and a mixed inhibitor with respect to oxygen. However, the chloride and bromide ions are competitive inhibitors with respect to the electron donor. The constants of inhibition of the enzyme activity by both chloride and fluoride ions and the catalytic constant were found to be pH-dependent. Based on the pH-dependence of the catalytic constant, an existence of two ionogenic groups in the enzyme active site has been proposed. The existence of an alternative electron pathway in the enzyme active site is postulated. This pathway makes a noticeable contribution to the reaction rate when the concentration of the electron donor and the fluoride ion is high. This alternative electron pathway can be blocked by the chloride ions and the hydroxyl ions taken at high concentrations. A formal kinetic description of this phenomenon has been given and the role of the type 2 Cu2+ in the catalytic process has been evaluated.

PMID: 7295828, UI: 82046948

J Biol Chem 1980 Jun 10;**255(11):**5000-5003

A new copper(II) electron paramagnetic resonance signal in two laccases

and in cytochrome c oxidase.

Reinhammar B, Malkin R, Jensen P, Karlsson B, Andreasson LE, Aasa R, Vanngard T, Malmstrom BG

A new EPR signal from Cu2+ has been discovered in reductive experiments with type 2 copper-depleted laccase from Polyporus versicolor. A novel EPR signal has also been found in native laccase from Rhus vernicifera on oxidation of the reduced protein with H2O2. In reoxidation experiments with cytochrome c oxidase from beef heart, a new Cu2+ signal has been observed. With Rhus laccase, the new signal is shown to originate from one of the copper ions that are nondetectable in the resting enzyme, and evidence is presented for the signals in Polyporus laccase and cytochrome c oxidase also stemming from the metal pairs that are antiferromagnetically coupled in the oxidized enzymes. The new signals show strong rhombic character, and the EPR parameters place them in a category different from the signals of type 1 as well as of type 2 Cu2+ ions.

PMID: 6246091, UI: 80182181

Biochim Biophys Acta 1978 Oct 12;**526(2):**311-317

Magnetic susceptibility of laccases and ceruloplasmin.

Petersson L, Angstrom J, Ehrenberg A

1. Recent magnetic susceptibility measurements on laccase (monophenol,dihydroxyphenylalanine:oxygen oxidoreductase, EC 1.14.18.1) from the lacquer tree Rhus vernicifera showed a deviation from Curie behaviour above 50 K, which was taken as evidence for an antiferromagnetically coupled Cu(II)-Cu(II) pair in the oxidized enzyme. The magnetic susceptibility of this protein has been reinvestigated. Further measurements on laccase from the fungus Polyporus versicolor and human ceruloplasmin (iron(II):oxygen oxidoreductase, EC 1.16.3.1) are presented. 2. The magnetic susceptibility of fungal laccase and lacquer tree laccase can be accounted for by the EPR detectable copper ions in the temperature range 40--300 K. 3. If an antiferromagnetically coupled Cu(II)-Cu(II) pair exists in the laccases, then the coupling, expressed as --J, should be at least of the order of 300 cm-1, as deduced from the Curie dependence of the susceptibility and the sensitivity in our measurements. 4. If an analogy with the laccases is assumed for the EPR invisible copper in ceruloplasmin then a limiting value of the coupling may be deduced also in this case, with --J at least of the order of 200 cm-1.

PMID: 214124, UI: 79062408

Appl Environ Microbiol 1977 Apr;**33(4):**836-839

Cell growth and catecholase production for Polyporus versicolor in submerged culture.

Carroad PA, Wilke CR

Cell growth and catecholase production for Polyporus veriscolor (ATCC 12679) were studied in mechanically agitated submerged culture, as functions of temperature. The exponential-phase growth rate exhibited a maximum at 28 degrees C. Over the range of 20 degrees C to approximately 30 degrees C, both cell mass and enzyme yield factors were constant. At higher temperatures (30 to 40 degrees C) cell mass yield factor decreased and enzyme yield factor increased. Specific respiration rate of P. versicolor was determined. Thermal deactivation of catecholase was investigated between 30 and 50 degrees C, and deactivation rates were fit to an Arrhenius rate expression.

PMID: 869531, UI: 77200564

Appl Environ Microbiol 1977 Apr;**33(4):**871-873

Exponential growth kinetics for Polyporus versicolor and Pleurotus ostreatus in submerged culture.

Carroad PA, Wilde CR

Simple mathematical models for a batch culture of pellet-forming fungi in submerged culture were tested on growth data for Polyporus versicolor (ATCC 12679) and Pleurotus ostreatus (ATCC 9415). A kinetic model based on a growth rate proportional to the two-thirds power of the cell mass was shown to be satisfactory. A model based on a growth rate directly proportional to the cell mass fitted the data equally well, however, and may be preferable because of mathematical simplicity.

PMID: 559472, UI: 77200569

Biochim Biophys Acta 1976 Oct 11;**445(3):**579-597

Kinetic studies of Rhus vernicifera laccase. Role of the metal centers in electron transfer.

Andreasson LE, Reinhammar B

The reactions of Rhus vernicifera (monophenol,dihydroxyphenylalanine: oxygen oxidoreductase, EC 1.14.18.1) with the reducing substrates hydroquinone and ascorbic acid have been investigated with the stopped-flow technique. Rhus laccase appears to be present in two molecular forms with a pH-sensitive equilibrium constant regulating the relative concentrations of each species. A model for the reaction of Rhus laccase with reducing substrates has been formulated. The model is similar to one formulated earlier for the anaerobic reduction of laccase from Polyporus versicolor (Andreasson, L.-E., Malstrom, B.G., Stromberg, C. and Vanngard, T. (1973) Eur. J. Biochem. 34, 434-439) and accounts for the reduction also of this enzyme. The essentials of the model are as follows: Electrons are taken up from reductants one at a time. The type 1 Cu2+ has a central role in mediating the transfer of at least one of the electrons needed for the reduction of the co-operative two-electron acceptor. Intramolecular reactions determine the concentrations of two molecular forms of the enzyme and influence the rate of reduction of the two-electron acceptor. The model, which has been used for successful simulations of the anaerobic reduction of Rhus laccase, is capable of explaining the reduction of laccases also in the presence of the inhibitor F-. In addition, the model gives an explanation of the behaviour of the laccases when reducing substrates and O2 are simultaneously present and is consistent with earlier observations of the post-steady-state reduction of the type 1 Cu2+ and the two-electron accetor (Holwerda, R.A. and Gray, H.B. (1974) J. Am. Chem. Soc. 96, 6008-6022).

PMID: 9990, UI: 77022138

G Batteriol Virol Immunol 1975 Jul;**68(7-12):**165-174

[Selection in Polyporus versicolor of mutants producing laccase].

[Article in Italian]

Valenti P

Following preceeding research on the production of laccase in Polyporus versicolor the A. has studied the various cultural conditions which are favourable to a good production of the enzyme. By selecting U.V. induced mutants it has been possible to isolate strains with a high production of the enzyme, in which the enzyme is either constitutive or inducible.

PMID: 1234586, UI: 77049434

Can J Biochem 1970 Dec;**48(12):**1351-1358

Fungal metabolism of flavonoids. Purification, properties, and substrate specificity of an inducible laccase from Polyporus versicolor PRL 572.

Pickard MA, Westlake DW

PMID: 4995114, UI: 71166277

Can J Microbiol 1969 Aug;**15(8):**869-873

Meatabolism of rutin by Polyporus versicolor PRL 572.

Pickard MA, Westlake DW

PMID: 4981163, UI: 70008748

Biochim Biophys Acta 1968 Aug 6;**165(1):**145-163

Degradation of the lignin model compound syringylglycol-beta-guaiacyl ether by Polyporus versicolor and Stereum frustalatum.

Kirk TK, Harkin JM, Cowling EB

PMID: 4970522, UI: 68397768

Biochim Biophys Acta 1968 Aug 6;**165(1):**134-144

Oxidation of guaiacyl- and veratryl-glycerol-beta-gualacyl ether by Polyporus versicolor and Stereum frustulatum.

Kirk TK, Harkin JM, Cowling EB

PMID: 4970521, UI: 68397767

Acta Chem Scand 1967;**21(9):**2367-2378

Large scale production and purification of laccase from cultures of the fungus Polyporus versicolor and some properties of laccase A.

Fahraeus G, Reinhammar B

PMID: 5585673, UI: 68233078