INTERNATIONAL SOCIETY FOR MEDICINAL MUSHROOMS

国际药用菌学会

International Society for Medicinal Mushrooms （ISMM）was founded in Vancouver, Canada. As a global non-profit organization, ISMM promotes the development of research, education, production, transportation, marketing and cultivation of medicinal mushrooms to have people to work towards common aspirations and goals. The integration will increase the impact of the international medicinal mushroom industry and benefit the health of people in the world.

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国际药用菌学会（International Society for Medicinal Mushrooms），简称ISMM，在加拿大温哥华注册成立，由从事药用菌产业的科研、教学、生产、流通、市场、文化及相关产业链的单位、团体和个人自愿组成的为实现共同意愿的非营利性国际组织。本学会致力于促进国际药用菌产业各个领域的融合与发展，以提升药用菌行业在全球的影响力，造福人类健康。

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NEWSLETTER OF THE INTERNATIONAL SOCIETY FOR MEDICINAL MUSHROOMS

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News Reports

Why Mushrooms will be A Superpowered Food in 2022

By Bérangère Chatelain

© cholprapha /Shutterstock Reishi mushrooms are claimed to have anti-inflammatory virtues and even help reduce high blood pressure.

Named ingredient of the year by the New York Times, mushrooms are going far beyond the realm of omelets, pizza topping and canned soup. In 2022, the star of the fall harvest will not only be popular in our stirfry, but also in a host of new food products designed to do us good. There's even a name for it: "mushroom tech."

Peas, cashews, potatoes or even hemp: plant-based milk counts an ever-increasing number of sources as it becomes a heavyweight alternative and even rival to cow's milk. At the recent 2022 CES tech event, which just closed its doors in Las Vegas, a new genre was introduced: mushroom milk. And it involves much more than just squeezing out the liquid of an enoki or oyster mushroom to obtain vegetable milk! An American company has unveiled a formula based on water, sunflower oil, sugar cane, all mixed with mushroom powder rich in vitamin D2.

Alongside the ancillary ingredients, the major component of the recipe is a vegetable protein obtained after fermentation of mushrooms. To provide alternatives to food products containing the most common allergens, such as soy, nuts or milk, MycoTechnology has developed a plant-based substance that can be used in a wide range of foods, from steak to bread. In its Aurora, Colorado facility, it extracts proteins from rice and peas and ferments them with the world's second most cultivated mushroom: shiitake. Welcome to "mushroom tech," the new technology that uses and takes advantage of all the virtues of mushrooms to develop food products.

Mushrooms and well-being

In many recipes, mushrooms are both essential and discreet, providing key flavors but not upstaging other ingredients. And they're having a moment as the world market for mushrooms is booming. According to research and analysis firm Technavio, sales of mushrooms are expected to grow by 18.78 billion dollars by 2025. Indeed, companies have decided to use it in all sorts of ways, not just in ordinary recipes, but in a host of food innovations dedicated to preserving our health.

Vitamin C, fiber, selenium, potassium... From the top of its cap to its stalk, a mushroom contains a cocktail of nutritional treasures capable of reducing inflammation and maintaining cardiovascular health by helping combat high blood pressure. An analytical study by the international firm Data Bridge Market Research even refers to this foodstuff as a medicinal ingredient, which could feed a specific market whose growth is estimated at 9.85% by 2027.

And sometimes the innovations are nothing short of surprising. In England, a young naturopath had the idea of brewing a range of beers using different mushrooms to take advantage of the medicinal virtues of varieties such as reishi, lion's mane and chaga: the first is claimed to have anti-inflammatory virtues, the second to have beneficial actions on the digestive system and the third is nicknamed the immunity mushroom. The London-based brand Fungtn has injected a small dose of these wellness boosters into an IPA, a lager and a tropical fruit-flavored reference, all of which are low in alcohol.

In the United States, the So Good So You brand has used so-called adaptogenic mushrooms, which are said to be able to reduce the effects of stress, to launch a new range of shots, those drinks packaged in small bottles, promoted as energy providers.

And finally a creamer made from mushrooms. The plant-based alternative to creamer that you pour into a cup of coffee is becoming a functional product at American brand Four Sigmatic. The Los Angeles-based brand promises that, when you take your next coffee break, you'll be able to control your stress better and even make your skin glow thanks to this powder... the whole nine yards!

Higher Mushroom Consumption is Associated with A Lower Risk of Cancer

By Tracy Cox

Next time you make a salad, you might want to consider adding mushrooms to it. That's because higher mushroom consumption is associated with a lower risk of cancer, according to a new Penn State study, published on March 16 in Advances in Nutrition.

The systematic review and meta-analysis examined 17 cancer studies published from 1966 to 2020. Analyzing data from more than 19,500 cancer patients, researchers explored the relationship between mushroom consumption and cancer risk.

Mushrooms are rich in vitamins, nutrients and antioxidants. The team's findings show that these super foods may also help guard against cancer. Even though shiitake, oyster, maitake and king oyster mushrooms have higher amounts of the amino acid ergothioneine than white button, cremini and portabello mushrooms, the researchers found that people who incorporated any variety of mushrooms into their daily diets had a lower risk of cancer. According to the findings, individuals who ate 18 grams of mushrooms — about 1/8 to 1/4 cup — daily had a 45% lower risk of cancer compared to those who did not eat mushrooms.

"Mushrooms are the highest dietary source of ergothioneine, which is a unique and potent antioxidant and cellular protector," said Djibril M. Ba, a graduate student in epidemiology at Penn State College of Medicine. "Replenishing antioxidants in the body may help protect against oxidative stress and lower the risk of cancer."

When specific cancers were examined, the researchers noted the strongest associations for breast cancer as individuals who regularly ate mushrooms had a significantly lower risk of breast cancer. Ba explained that this could be because most of the studies did not include other forms of cancer. Moving forward, this research could be helpful in further exploring the protective effects that mushrooms have and helping to establish healthier diets that prevent cancer.

"Overall, these findings provide important evidence for the protective effects of mushrooms against cancer," said coauthor John Richie, a Penn State Cancer Institute researcher and professor of public health sciences and pharmacology. "Future studies are needed to better pinpoint the mechanisms involved and specific cancers that may be impacted."

Paddy Ssentongo, Joshua Muscat, Robert Beelman and Xiang Gao from Penn State also contributed to this research. The researchers declare no conflicts of interest or specific funding support.

Source: www.psu.edu

Up-coming Events

The Dutch Mushroom Days Moved to July 2022

6-8 July 2022, De Brabanthallen, 's-Hertogenbosch

The Dutch mushroom industry is well known and one of the biggest players in the mushroom industry worldwide! The Mushroom Days is the perfect platform for National and International companies to present their technologies and services and to get the latest information and insights from the international industry. This event is the platform to meet all relevant mushroom growers and related industry players.

The Dutch Mushroom Days, originally planned to take place 30 March – 1 April 2022, has been moved to **July 6-8, 2022**, the organizers communicated on 20 October.

According to Piet Lempens, Chairman of the Mushroom Days Foundation, already 80% of the floor space in the Brabanthallen has been reserved by making a down payment. “We are very grateful for this cooperation, it shows great enthusiasm to make it into a unique event again together. The exhibitors expressed their concern that it might not (yet) be possible for everyone to visit the Mushroom Days at the end of March. In particular, the quarantine obligation as it currently applies in some countries constitutes a serious travel restriction. As an organisation, we shared this justified concern”, Lempens said.

With the cancellation of the NAMC in Vancouver (June 2022) space was created in the international agenda of trade fairs and conferences for the mushroom sector. This decision gave the Foundation the opportunity to return to the usual time of the year. Covid-19 vaccination coverage is rising worldwide, and more and more countries are announcing

further relief of travel restrictions. A broad consultation has made the board of the Foundation therefore decide to postpone the Mushroom Days by more than 3 months to the 6th, 7th and 8th of July 2022. “This also will allow the usual build-up time for exhibition stands. The board believes that this decision does justice to the large number of registrations and the enthusiasm of the participants, as well as to the concern about the (currently) applicable travel restrictions. There are never certainties, but 3 months extra is valuable time.”

The go/no-go moment of November 1, 2021, will therefore be a definitive ‘go’. “Only government restrictions can prevent this edition to take place. Unexpected escalation of Covid-19 cannot be completely ruled out. Therefore, the current conditions of participation remain in effect for all subscriptions. The Mushroom Days Committee will soon start positioning the already registered participants on the floor map. If the changed date affects the participation or the dimensions (and/or type) of booked stand, the organisers would like to hear from you. The call to register soon for the remaining 20% of stand space remains actual.”

“The need to meet in person again remains strongly felt and the Mushroom Days are an excellent opportunity to do so.”

Source: www.mushroomdays.com, https://mushroombusiness.com/

The 11th International Medicinal Mushroom Conference 2022

Welcome to the

IMMC11- The 11th International Medicinal Mushroom Conference

Belgrade, Serbia, Crowne Plaza Hotel

September 27-30th, 2022.

We are delighted to invite you to the 11th International Medicinal Mushroom Conference which will be held in Belgrade, at the end of September 2022.

After more than two successful decades of the International Journal of Medicinal Mushroom (IJMM), launched in 1999 by Begell House Inc. (USA) and the organization of a series of ten International Medicinal Mushroom Conferences (IMMC), first one held in Kiev, Ukraine, in 2001., followed by IMMC2 in Pattaya, Thailand, 2003; IMMC3 in Port Townsend, Washington, USA, 2005; IMMC4 in Ljubljana, Slovenia 2007; IMMC5 in Nantong, China, 2009.; IMMC6 in Zagreb, Croatia 2011; IMMC7 in Beijing, China, 2013; IMMC8 in Manizales, Colombia 2015.; IMMC9 in Palermo, Italy 2017. and the IMMC10 in Nantong, China, 2019. we proudly announce the 11th IMMC, as the first International Conference in the third decade of the IMMC;

Belgrade is located on the confluence of Danube and Sava and the crossroads of the Pannonian Plain and the Balkan Peninsula in Europe. It is one of the oldest continuously inhabited cities in Europe and maintains a vibrant city atmosphere today, with a population of 2 million people buzzing with life. For centuries it has been a meeting point among different civilizations and today among different scientists.

We cordially invite scientists, students, mycologists, medical doctors, pharmacologist, immunologists, contagious disease specialists, naturopaths, biochemists, and all those who are interested in studying and discussing the most current research on medicinal mushrooms and their properties to join us at the end of September, the most beautiful month in Belgrade. We are looking forward to welcoming you at the IMMC11 Conference in Belgrade.

Prof. Dr. Miomir Niksic
IMMC11 Organizing Committee, President
Institute of Food Technology and Biochemistry
Faculty of Agriculture, University of Belgrade

THE THEME OF THE CONFERENCE:

Medicinal Mushroom Science: Innovation, Challenges and Perspectives

Organized by:

International Society for Medicinal Mushrooms and University of Belgrade

Co-organized by:

Faculty of Agriculture – Belgrade
Mycological Society of Serbia
Faculty of Biology – Belgrade
Faculty of Natural Science -Kragujevac
IBISS- Institute for Biological Research "Siniša Stanković"
EHEDG – The European Hygienic Engineering & Design Group
Faculty of Science – Novi Sad
Faculty of Pharmacy – Belgrade

KEY TOPICS:

① Biodiversity of medicinal mushrooms (conservation, taxonomy and ecological distribution);
② Genetics and breeding of medicinal mushrooms (including molecular biology);
③ New trends in the cultivation, industrial production and fermentation of medicinal mushrooms
④ Biochemistry and pharmacology of medicinal mushrooms active compounds;
⑤ Medicinal mushrooms in veterinary and agriculture;
⑥ Medicinal mushrooms in clinical practice; antiviral and antimicrobial compounds;
⑦ Nutritional and medicinal value of mushroom products;
⑧ Industrialization of medicinal mushrooms products (including management, marketing, laws and regulations, standardization, ecotourism and mushroom hunting);
⑨ Psychedelic Mushrooms: Research, opportunities and the future for Psilocybe in medicine.

ABSTRACT SUBMISSION

We would be pleased to receive abstracts from interested authors that follow the symposia themes. Abstracts should focus on current issues, relevant ongoing research and/or progress made in culinary-medicinal mushroom industry and should present scientific and/or of technical content.

Your abstracts should clearly define the objectives of the presentation or the topics covered, key conclusions reached, and potential benefits for scientific development and progress made in the industry. Abstracts length should not exceed 500 words and not have less than 300 words.

The abstracts will be published in the electronic book of abstracts.

The electronic version must be prepared in Microsoft Word and in required abstract format and should be submitted online (https://www.immc11.com/abstract/) before 15th May.

Information on acceptance or rejection of abstracts will be sent out via email.

REGISTRATION

REGISTRATION FEES

Type	Early bird registration until 30.06.2022.	Late registration from 01.07.2022. until 20.09.2022.
PhD students	200 €	240 €
HINARI A & B * List countries	320 €	370 €
Regular attendees	420 €	490 €

*All prices are in Euros and include VAT 20%

*HINARI Group A&B: Participants residing in lower- and middle income countries. A list of HINARI countries can be found here.

*In order to increase accessibility to the IMMC11 Congress resources to all researchers and professionals coming from low resource countries, IMMC11 Organizing Committee decided to apply HINARI list of countries model for DISCOUNTED registration fees for those participants coming from ELIGABLE countries (HINARI Group A & B).

*PhD Student registration forms must be accompanied by a proof (a signed letter from the head of the department or other corresponding document) confirming the PhD student's status

Registration fee includes: access to all scientific sessions, access to poster sessions, access to exhibition and industry sessions, lunch and coffee breaks, welcome reception

IMPORTANT DATES & DEADLINES

- February 2022 Opening of online registration
- February 18, 2022 Distribution of second announcement
- Promotional campaigns and updates as of February 2022, on monthly basis
- 15 May 2022 Abstract submission deadline
- 15 June 2022 Notification to authors of abstract acceptance
- 30 June 2022 Early bird registration deadline
- 31 July 2022 Full paper submission deadline
- 31 August 2022 Closing date for registrations on-line and accommodations
- 26 September 2022 Registration desk opens
- 27-30 September 2022 IMMC11 congress venue

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2022 International Mushroom Days Postponed

In light of the continuing pandemic and ongoing group gathering and travel restrictions, the organization committee of International Mushroom Days has made the difficult decision to postpone the 2022 International Mushroom Days.

The 2022 International Mushroom Days, originally scheduled to be held in Xiamen Fliport C&E Center, China at the end of March has been postponed. It may re-opening according to pandemic sistituation.

2022 International Mushroom days will be hosted by China Chamber of Commerce of I/E of Foodstuffs, Native Produce and Animal By-products (CFNA), organized by Xiamen Vissea Exhibition Service Co., LTD., Xiamen Wutong Fliport Hotel and Xiamen Fliport C&E Center. The Expo will help rural revitalization, promote innovation and development of the whole industrial chain of Chinese edible mushroom, promote the integration of domestic and foreign trade, all-channel layout and sustainable development, and the high-quality products of the whole industrial chain of mushroom at home and abroad in the post-epidemic era.

As an upgraded version of the 2020 International Mushroom Days (Xiamen), the new Expo with an extended scale will occupy the first and second floor exhibition halls of Xiamen Fliport C&E Center. The organizing committee will pay more attention to the effective combination of the conference and exhibition, and make use of the space advantages to create an integrated exhibition. The first floor of the exhibition hall will be used as the Intelligent Manufacturing and Innovative Pavilion of Mushroom, which will display various equipment and supporting facilities, including raw and auxiliary materials, production, sterilization, inoculation, environmental simulation, packaging and processing. On the second floor, a mushroom industry revitalization hall will be set up to display the achievements of rural revitalization and the style of premium edible mushroom brand enterprises. The total scale of the Expo will be 15,000 square meters with about 600 international standard booths.

Xiamen Wutong Fliport Hotel and Xiamen Fliport C&E Center

As the conference date approaches, we have been seeing previously lifted government restrictions reintroduced and many re-opening plans put on pause, all of which could significantly impact conference participation. Ultimately, this uncertainty left us with a tough decision, but one we feel we had to make.

Contact mail: imd_info@163.com.

Research progress

Medicinal mushrooms: clinical perspective and challenges

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Abstract: Mushrooms are valued by humans worldwide as food, but also for their medicinal properties. Over 130 medicinal effects of mushrooms have been reported, including anti-diabetic, antioxidant, antimicrobial, anticancer, prebiotic, immunomodulating, anti-inflammatory and cardiovascular benefits. Several mushrooms have been tested in phase I, II, or III clinical trials for various diseases, including cancers, as well as to modulate immunity. Here, we review clinical studies on medicinal mushrooms or preparations (but not pure compounds) derived thereof. Overall, few phase III trials have been performed, and in many cases, these trials included a relatively small number of patients. Therefore, despite the promising published clinical data, especially on immune modulation, more work is required to clarify the therapeutic value of mushrooms.

Drug Discovery Today, Volume 27, Issue 2, 2022, Pages 636-651, ISSN 1359-6446, DOI: 10.1016/j.drudis.2021.11.017

Water Extract of the Chaga Medicinal Mushroom, *Inonotus obliquus* (Agaricomycetes), Inhibits SARS-CoV-2 Replication in Vero E6 and Vero Cell Culture Experiments

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Abstract: The antiviral properties of water extracts from pharmaceutical raw materials of the chaga mushroom, *Inonotus obliquus*, were studied against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). All studies with infectious materials were carried out in an isolated virological laboratory of the State Research Center of Virology and Biotechnology Vector of Rospotrebnadzor, which has a sanitary and epidemiological conclusion for the right to work with pathogenic biological agents of I–II pathogenicity groups. Antiviral activity was determined by the ability of *I. obliquus* water extracts to inhibit the replication of SARS-CoV-2 (nCoV/Victoria /1/2020 strain) in *Vero* E6 and *Vero* cell cultures. The results of these studies showed that water extracts of *I. obliquus* are characterized by low toxicity in *Vero*

and *Vero E6* cell cultures and have antiviral activity against SARS-CoV-2. The 50% inhibitory concentration ranged from 0.75 to 11.6 μg/mL. A patent for the invention was received (Patent RU, 2741714 C 1, 2021).

Keywords: SARS-CoV-2, COVID-19 pandemic, basidiomycetous fungi, chaga mushroom, *Inonotus obliquus*, antiviral activity, medicinal mushrooms

International Journal of Medicinal Mushrooms, Volume 24, 2022 Issue 2, pages 23-30, DOI: 10.1615/IntJMedMushrooms.2021042012

Different ways to exploit mushrooms: A review

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Abstract: Mushrooms are a nutritionally, economically, and biotechnologically valuable group of organisms. They are packed with nutritional value in the form of low calories, high protein, and fiber contents. Besides being an important source of food, mushrooms are exploited by man in various ways. Mushrooms can be used in the pharmaceutical industry as antioxidant, anticancer, and immunomodulating agents. They are, at the same time beneficial for human beings and forests as nutrient recyclers in the form of natural decomposers. Mushrooms are also the best source to attain sustainable development goals set by the UNO. Food insecurity, malnutrition and pollution are some of the major issues faced by the modern world in the recent era. Mushrooms in the form of mushroom farming are a promising way to overcome these challenges. Mushroom farming is an efficient way for agro-industrial waste disposal and ensures food security. It is also the cheapest source to make up for the deficiency caused by malnutrition. It supports the local economy by providing more opportunities for livelihood and income by local and national trade. The present review emphasizes the comprehensive account of the different aspects of mushrooms exploitation by which it can save the planet earth and people living on it.

Keywords: Mushrooms cultivation, nutritional, therapeutic values, food security, zero-emission strategy, non-green revolution, increase livelihood

Frontiers in Life Science, 2021, VOL. 14, NO. 1, 450-460, DOI: 10.1080/26895293.2021.1919570

Human Hemoglobin S Erythrocyte-Stabilizing and Antisickling Potential of Extract of Wood Ear Mushroom, *Auricularia auricula* (Agaricomycetes)

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Abstract: The increased prevalence and mortality of sickle cell disease necessitates more research on its management and treatment. This study investigated the antisickling potential of *Auricularia auricula* obtained from its natural environment within the University of Port Harcourt in Nigeria. Freshly harvested mushrooms were washed, air-dried,

and ground and distilled water was added. The mixture was divided into two parts; one part was extracted by cold maceration and lyophilized to give cold maceration extract, while the filtrate obtained after boiling and cooling of the second part was dried in an autodesiccator to give decoction extract. Volumes of both extracts were obtained via serial dilution. Sickle cell hemoglobin S (HbS) erythrocytes were obtained by centrifuging HbS-blood in 0.9% physiological saline. The percentage of lysis decreased when 10 and 5 mg/mL of both extracts were added to erythrocytes suspended in hypotonic buffered saline, while the lowest median corpuscular fragility was observed for cold maceration extract at 5 mg/mL. The lowest negative percentage of stability and highest morphological stability were observed for decoction extract at 10 and 5 mg/mL after 5 min of culturing in decoction extract, respectively. The ability of *A. auricula* extracts (mainly the decoction extract) to reverse and stabilize erythrocyte membrane integrity and morphology is a clear indication that this mushroom may offer a valuable natural option for the treatment and management of sickle cell anemia.

Keywords: *Auricularia auricula*, medicinal mushrooms, hemoglobin S, decoction, cold maceration, sickle cell, erythrocytes, lysis, fragility

International Journal of Medicinal Mushrooms, Volume 24, 2022 Issue 3, *DOI:* ***10.1615/IntJMedMushrooms.2022042977***

Effect of tiger milk mushroom (*Lignosus rhinocerus*) supplementation on respiratory health, immunity and antioxidant status: an open-label prospective study

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Abstract: Tiger milk mushroom (TMM; *Lignosus rhinocerus*) have been used for a long time by indigenous communities in South East Asia regions as traditional medicine for different ailments, including respiratory disorders. The beneficial effects of TMM have been proven through in vivo and in vitro models, but these effects have yet to be validated in a clinical study. In this study, the beneficial effects of TMM supplementation were investigated in 50 voluntary participants. Participants were required to take 300 mg of TMM twice daily for three months. Level of interleukin 1β (IL-1β), interleukin 8 (IL-8), immunoglobulin A (IgA), total antioxidant capacity, malondialdehyde (MDA), 3-nitrotyrosine (3-NT), 8-hydroxydeoxyguanosine (8-OHdG), pulmonary function and respiratory symptoms were assessed during baseline and monthly follow-up visits. Results demonstrated that supplementation of TMM significantly ($p < 0.05$) suppressed the level of IL-1β, IL-8, MDA, as well as respiratory symptoms. In additional to that, TMM also significantly ($p < 0.05$) induced the level of IgA, total antioxidant capacity, as well as pulmonary function. Analyses of data indicated that gender and BMI were factors influencing the outcomes of antioxidant status. Collectively, our findings suggested that TMM supplementation effectively improves respiratory health, immunity and antioxidant status.

Scientifc Reports, (2021) 11:11781, DOI: 10.1038/s41598-021-91256-6

A review of the therapeutic and biological effects of edible and wild mushrooms

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Abstract: Throughout history, mushrooms have occupied an inseparable part of the diet in many countries. Mushrooms are considered a rich source of phytonutrients such as polysaccharides, dietary fibers, and other micronutrients, in addition to various essential amino acids, which are building blocks of vital proteins. In general, mushrooms offer a wide range of health benefits with a large spectrum of pharmacological properties, including antidiabetic, antioxidative, antiviral, antibacterial, osteoprotective, nephroprotective, hepatoprotective, etc. Both wild edible and medicinal mushrooms possess strong therapeutic and biological activities, which are evident from their in vivo and in vitro assays. The multifunctional activities of the mushroom extracts and the targeted potential of each of the compounds in the extracts have a broad range of applications, especially in the healing and repair of various organs and cells in humans. Owing to the presence of the aforementioned properties and rich phytocomposition, mushrooms are being used in the production of nutraceuticals and pharmaceuticals. This review aims to provide a clear insight on the commercially cultivated, wild edible, and medicinal mushrooms with comprehensive information on their phytochemical constituents and properties as part of food and medicine for futuristic exploitation. Future outlook and prospective challenges associated with the cultivation and processing of these medicinal mushrooms as functional foods are also discussed.

Keywords: Mushroom, nutraceuticals, fungal biomass, pharmacological properties, functional foods, active compounds

Bioengineered, 2021, VOL. 12, NO. 2, 11239-11268, DOI: 10.1080/21655979.2021.2001183

Health benefits of edible mushroom polysaccharides and associated gut microbiota regulation

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Abstract: Edible mushrooms have been an important part of the human diet for thousands of years, and over 100 varieties have been cultivated for their potential human health benefits. In recent years, edible mushroom polysaccharides (EMPs) have been studied for their activities against obesity, inflammatory bowel disease (IBD), and cancer. Particularly, accumulating evidence on the exact causality between these health risks and specific gut microbiota species has been revealed and characterized, and most of the beneficial health effects of EMPs have been associated with its reversal impacts on gut microbiota dysbiosis. This demonstrates the key role of EMPs in decreasing health risks through gut microbiota modulation effects. This review article compiles and summarizes the latest studies that focus on the health benefits and underlying functional mechanisms of gut microbiota regulation via EMPs. We conclude that EMPs can be considered a dietary source for the improvement and prevention of several health risks, and this review provides the theoretical basis and technical guidance for the development of novel functional foods with the utilization

of edible mushrooms.

Keywords: Cancer, edible mushroom polysaccharides, gut microbiota, health improvement, obesity inflammatory bowel disease

Critical Reviews in Food Science and Nutrition, 2021(2):1-18, DOI: 10.1080/10408398.2021.1903385

Proteomic Research on the Antitumor Properties of Medicinal Mushrooms

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Abstract: Medicinal mushrooms are increasingly being recognized as an important therapeutic modality in complementary oncology. Until now, more than 800 mushroom species have been known to possess significant pharmacological properties, of which antitumor and immunomodulatory properties have been the most researched. Besides a number of medicinal mushroom preparations being used as dietary supplements and nutraceuticals, several isolates from mushrooms have been used as official antitumor drugs in clinical settings for several decades. Various proteomic approaches allow for the identification of a large number of differentially regulated proteins serendipitously, thereby providing an important platform for a discovery of new potential therapeutic targets and approaches as well as biomarkers of malignant disease. This review is focused on the current state of proteomic research into antitumor mechanisms of some of the most researched medicinal mushroom species, including *Phellinus linteus*, *Ganoderma lucidum*, *Auricularia auricula*, *Agrocybe aegerita*, *Grifola frondosa*, and *Lentinus edodes*, as whole-body extracts or various isolates, as well as of complex extract mixtures.

Keywords: cancer, medicinal mushrooms, proteomics, bioinformatics

Molecules, 2021, 26(21), 6708, DOI: 10.3390/molecules26216708

The antioxidant potential of different edible and medicinal mushrooms

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Abstract: Mushroom consumption has grown extraordinarily owing to their high nutritional value, desirable taste, and aroma. Mushrooms continue generating lots of interest chiefly in their consumption as food, as a cure for different ailments, as well as important goods for commerce throughout the globe owing to their dietary, antioxidant, and therapeutic values. Higher Ascomycetes and Basidiomycetes mushrooms have different properties with anticancer and immunological potential. They as well provide vital health benefits and display a wide-ranging continuum of pharmacological effects. The antioxidant activity of different mushrooms was reviewed for different radicals including DPPH, ABTS, OH, Nitrite, metals, and lipid peroxidation. The present review presents pharmacological activities of

different species of edible and medicinal mushrooms. This review provides tangible evidence that these mushrooms are an excellent source of natural constituents and antioxidants with potential application in pharmaceuticals and in treating and managing different diseases.

Keywords: mushrooms, medicinal properties, antioxidant potential, free radicals

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A concise review of mushrooms antiviral and immunomodulatory properties that may combat against COVID-19

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Abstract: The World Health Organization (WHO) declared COVID-19 as a pandemic on March 11, 2020, because of its widespread transmission and infection rates. The unique severe disease was found in Wuhan, China, since December 2019, and swiftly spread throughout the world. Natural chemicals derived from herbal medicines and medicinal mushrooms provide a significant resource for the development of novel antiviral drugs. Many natural drugs have been proven to have antiviral properties against a variety of virus strains, such as the coronavirus and the herpes simplex virus (HSV).. In this research, successful dietary treatments for different COVID illnesses were compared to potential of mushroom products in its therapy. In Google Scholar, Science Direct, PubMed, and Scopus, search keywords like COVID, COVID-19, SARS, MERS, mushrooms, and their compounds were utilized. In this review of the literature we foucsed popular mushrooms such as *Agaricus subrufescens* Peck*, Agaricus blazei* Murill, *Cordyceps sinensis* (Berk.) Sacc.*, Ganoderma lucidum* (Curtis.) P. Karst.*, Grifola frondosa* (Dicks.) Gray*, Hericium erinaceus* (Bull.) Pers.*, Inonotus obliquus* (Arch. Ex Pers.) Pilát.*, Lentinula edodes* (Berk.) Pegler*, Pleurotus ostreatus* (Jacq.) P. Kumm.*, Poria cocos* F.A. Wolf, and *Trametes versicolor* (L.) Lloyd.,. Changed forms of β-Glucan seem to have a good impact on viral replication suppression and might be used in future studies. However, the results seems terpenoids, lectins, glycoproteins, lentinan, galactomannan, and polysaccharides from mushrooms are promising prophylactic or therapeutic agents against COVID-19.

Keywords: mushrooms, immunomodulatory effect, antiviral activity, covid-19, β-glucan

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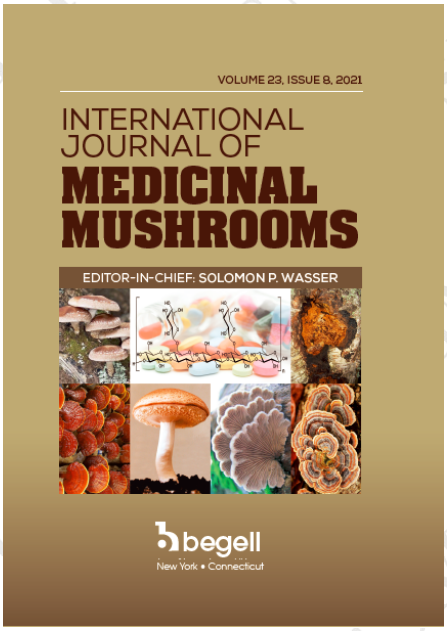
International Journal of Medicinal Mushrooms Call for Papers

About *International Journal of Medicinal Mushrooms*



International Journal of Medicinal Mushrooms is a journal covering the technologies/fields/categories related to Applied Microbiology and Biotechnology (Q3); Drug Discovery (Q3); Pharmacology (Q3). It is published by Begell House Inc.. The overall rank of *International Journal of Medicinal Mushrooms* is 10594. According to SCImago Journal Rank (SJR), this journal is ranked 0.471. SCImago Journal Rank is an indicator, which measures the scientific influence of journals. It considers the number of citations received by a journal and the importance of the journals from where these citations come. SJR acts as an alternative to the Journal Impact Factor (or an average number of citations received in last 2 years). This journal has an h-index of 30. The best quartile for this journal is Q3.

The ISSN of *International Journal of Medicinal Mushrooms* journal is 15219437. An International Standard Serial Number (ISSN) is a unique code of 8 digits. It is used for the recognition of journals, newspapers, periodicals, and magazines in all kind of forms, be it print-media or electronic. *International Journal of Medicinal Mushrooms* is cited by a total of 618 articles during the last 3 years (Preceding 2020).

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Aims and Scope

The rapid growth of interest in medicinal mushrooms research is matched by the large number of disparate groups that currently publish in a wide range of publications. The *International Journal of Medicinal Mushrooms* is the one source of information that will draw together all aspects of this exciting and expanding field - a source that will keep you up to date with the latest issues and practice. The *International Journal of Medicinal Mushrooms* publishes original research articles and critical reviews on a broad range of subjects pertaining to medicinal mushrooms, including systematics, nomenclature, taxonomy, morphology, medicinal value, biotechnology, and much more. Papers on new techniques that might promote experimental progress in the aforementioned field are also welcomed. In addition to full-length reports of original research, the journal publishes short communications and interesting case reports, together with literature reviews. Letters to the editor on topics of interest to readers are also published.

For More Information and Submittion

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Points and Reviews

Medicinal Mushrooms --The Essential Guide

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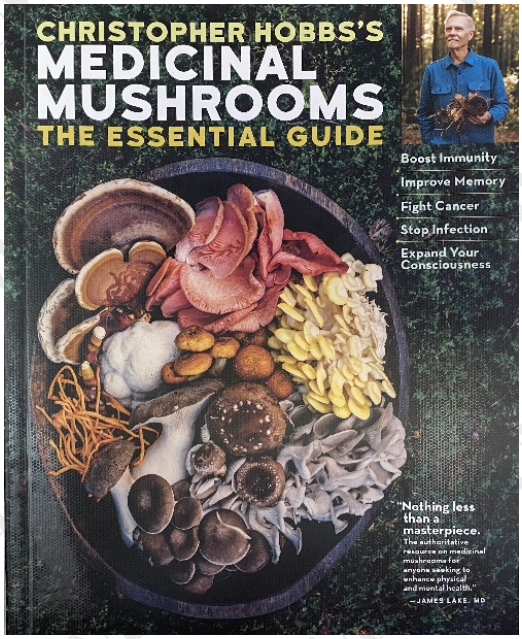

INTRODUCTION

Medicinal mushrooms have an established history of use in traditional oriental therapies. Contemporary research has validated and documented much of the ancient knowledge. The interdisciplinary field of science that studies medicinal mushrooms has sprung up and has increasingly demonstrated the potent and unique properties of compounds extracted from a range of species in the last three decades. Currently, the field is being developed into a very fruitful area. Modern clinical practice in Japan, China, Korea, Russia and other Asian countries rely on mushroom-derived preparations.

Ancient oriental medicine has stressed the importance of several mushroom species, mostly *Ganoderma lucidum* (W. Curt.: Fr.) P. Karst. (lingzhi or reishi) and *Lentinus edodes* (Berk.) Singer (shiitake). Mushrooms have also played an important role as a cure for ailments affecting the rural populations of Russia and other Slavic European countries. The most important species there were *Inonotus obliquus* (Pers.: Fr.) Pilat (chaga), *Fomitopsis officinalis* (Vill.: Fr.) Bond. et Singer, and *Fomes fomentarius* Fr.: Fr. These species were used in the treatment of gastrointestinal disorders, various forms of cancers, bronchial asthma, night sweats, etc. There is also a long history of traditional use of mushrooms as curatives in Mesoamerica (especially species of the genus *Psilocybe*).

Meanwhile, mushrooms comprise an extremely abundant and diverse world. The number of mushroom species on Earth is currently estimated at 140,000; yet perhaps only 10% (approximately 14,000 named species) are known to science. Mushrooms are being evaluated for their nutritional value and acceptability as well as for their pharmacological properties. They make up a vast and yet largely untapped source of powerful new pharmaceutical products. In particular, and most importantly for modern medicine, they present an unlimited source of polysaccharides and polysaccharide-protein complexes with anticancer and immunostimulating properties. Many, if not all, Agaricomycetes mushrooms contain biologically active polysaccharides in their fruit bodies, cultured mycelia, and cultured broth. The data on mushroom polysaccharides today are summarized for 700 species and intraspecific taxa.

Medicinal mushrooms are used as: a) dietary food (world mushroom production was 40 million tons in 2019); b) dietary supplement (DS) products (the market of MM DS products is rapidly growing and comprises a value of more than 20 billion US dollars per year); c) a new class of drugs called "Mushroom Pharmaceuticals"; d) natural bio-control agents in plant protection demonstrating insecticidal, fungicidal, bactericidal, herbicidal, nematocidal, and antiphytoviral activities; and e) cosmeceuticals – different compounds of MMs including polysaccharides, such as soluble β-glucans, glucuronoxylomannan (GXM), sacchachitin, tyrosinase, and other enzymes are used by cosmetic companies for their film-forming capability, activation of epidermal growth factor, antioxidative, antiallergic, antibacterial and anti-inflammatory activities, stimulation of collagen activity, inhibition of autoimmune vitiligo, and treating acne.

Recently studied medicinal actions of mushrooms included antitumor, immunomodulating, antioxidant, radical scavenging, cardiovascular, cholesterol-lowering, antiviral, antibacterial, anti-parasitic, antifungal, detoxicative, hepatoprotective, anti-diabetic**,** anti-obesity, neuroprotective, neurodegenerative, and some other effects as well. Also, substances derived from medicinal mushrooms can be used as painkillers and analgesics. The best implementation of medicinal mushrooms drugs and medicinal mushroom dietary supplements has been in preventing immune disorders and maintaining a good quality of life, especially in immunodeficient and immuno-depressed patients, patients under chemotherapy or radiotherapy, patients with different types of cancers, chronic blood-borne viral infections of Hepatitis B, C, and D, different types of anemia, the human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), Herpes simplex virus (HSV), chronic fatigue syndrome, Epstein Bar virus, patients with chronic gastritis and gastric ulcers caused by *Helicobacter pylori*, and people suffering from dementia (especially Alzheimer's disease).

Many mushroom preparations have shown clinically significant efficacy against human cancers: lentinan from *Lentinus edodes*, D-fraction from *Grifola frondosa*, schizophyllan from *Schizophyllum commune*, PSK (also called krestin), and PSP (polysaccharide peptide) from *Trametes versicolor,* befungin from *Inonotus obliquus,* etc. All these preparations are chemically high-molecular-weight polysaccharides, beta-D-glucans. These glucans induce their biological properties by stimulating the immune system. All these substances have been proven in clinical trials.

Mushroom polysaccharides prevent oncogenesis, show direct antitumor activity against various syngeneic tumors, and prevent tumor metastasis. Their activity is especially beneficial in clinics when used in conjunction with chemotherapy. Polysaccharides from mushrooms do not attack cancer cells directly but produce antitumor effects by activating different immune responses in the host.

Mushrooms contain biologically active polysaccharides in fruit bodies, cultured mycelium, and culture broth. Mushrooms produce beneficial effects not only as drugs but also as dietary supplements (DS). These are not strictly pharmaceutical products but produce their health effects through everyday use as part of a healthy diet. Every year we accumulate new evidence for the beneficial effects from DS made from mushrooms.

One significant problem with DS is their safety. They do not go through several strict phases of laboratory and clinical evaluations as do pharmaceutical drugs. Furthermore, a major problem associated with mushroom-based DS is their wide variability and the current lack of standards for production and testing protocols necessary to guarantee product quality. The active ingredient components of most present commercial mushroom products have not been indicated. There are some safety advantages of using mushroom-based dietary supplements, as opposed to herbal preparations. The advantages are the following. (1) The overwhelming majority of mushrooms used for production of DS are cultivated

commercially (and not gathered in the wild); this provides proper identification as well as pure and unadulterated products. In many cases, it also means genetic uniformity. (2) Mushrooms are easily propagated vegetatively and thus keep to one clone. The mycelium can be stored for a long time, and the genetic and biochemical consistency may be checked after considerable time. (3) The main advantage, in my opinion, is that many mushrooms can grow as mycelial biomass in submerged cultures.

The development of medicines and DSs from mushroom polysaccharides is hampered by the fact that high-molecular-weight compounds are used. These compounds cannot be synthesized artificially and their production, therefore, is restricted to extraction from fruit bodies or cultured mycelium. Such an approach imposes high-market prices. Today, science should concentrate on the beneficial medicinal effects of low-weight-molecular compounds produced by mushrooms.

It is with great pleasure to present my review of the very important book by Christopher Hobbs entitled “Medicinal Mushrooms. The Essential Guide”. Ch. Hobbs was the first author in the western world to publish the book “Medicinal Mushrooms. An Exploration of Tradition, Healing, & Culture” in 1986. Hobbs' book has been the most popular and most cited in the world on medicinal mushrooms with many new editions of the book since its publication. The value of Hobbs book cannot be overestimated. This book has been intensively used in universities and biotechnological companies.

SUMMARY OF THE BOOK

The new book, which is contains 270 pp., is an encyclopedic review and emphasizes worldwide trends and new developments in medicinal, edible, and cultivated mushrooms. The author discusses 100ds of different questions dedicated to medicinal mushrooms from general information to clinical trials, identifying different culinary-medicinal mushrooms including different recipes using various mushrooms. What is especially important is that much of the data included in the book is based not only on data from the literature but also on the author's own experience from more than 40 years as a practicing herbalist. The structure of this book is clear and compact. It is divided into 5 main parts plus a bibliography.

Chapter 1: "Mushrooms for Health and Healing".

Chapter 1 contains subchapters dedicated to general knowledge including historical information on the use of medicinal mushrooms from ancient times to the present time; chemical composition and active ingredients of medicinal mushrooms useful in promoting health, including information on minerals, vitamins, proteins, soluble and insoluble fiber, mushrooms support good gut microbiota, chitin, beta-glucans and their advantages, and activation of the immune system and antioxidant activities of mushroom compounds. Special attention was paid to terpenes and phenolic compounds. The last subchapter is dedicated to summarizing medicinal benefits, including the prevention of heart disease, diabetes, and cancer by strengthening and regulating immune functions, preventing, and treating infections, pathogenic viruses and bacteria, and the suppression of cancer cells. The author pays special attention to the medicinal actions of mushrooms in cognition, mind, and memory support, lifting mood and boosting energy, promoting sleep, sexual vitality, weight management, nerve and kidney, liver, digestive support, along with long-term use and habituation of mushrooms.

Chapter 2: "Making Mushroom Medicine".

In this chapter, based on the author's own experience, he reveals how to prepare or buy high-quality mushroom medicinal products and different mushroom based DSs. The author describes how to store mushrooms and mushroom products, including short-term storage, freezing, and dehydration for long-term storage. He also describes different types of mushroom extracts, including ways to extract and activate medicinal compounds under pressure, along with the preparation of concentrated extracts and their benefits. Special attention is given on how to use concentrated extract powders for basic tincture preparation, including double-extracted tinctures. Because tincturing is a cold extraction process and contains many low-molecular-weight compounds (like triterpenoids and phenols including polyphenols), the description of the tincturing process is dedicated to the importance of correctly combining mushrooms with plants (ginseng, astragals, ginger) for more effective results. This is a very important point the author makes because comparing medicinal values of fruiting bodies and mushroom mycelium products has been debated in the literature to secure the high quality of products made from cultivated mycelium and fruiting bodies. At the end of the second chapter, the author stresses the importance of standardization in the field of medicinal mushrooms as well as on the quality control of products based on checking polysaccharide and beta-glucan contents.

Chapter 3: "Top Medicinal Fungi".

This chapter is the core of the book, with 100 pages. The author describes the medicinal values of the most powerful medicinal mushrooms: species of genus *Agaricus*, *Inonotus obliquus* (chaga mushroom), *Opiocordyceps sinensis* and *Cordyceps militaris* (caterpillar fungi), *Hericium erinaceus* (lion's mane*), Grifola frondosa* (maitake), species of genera *Pleurotus* (oyster mushrooms) and *Ganoderma* (with special attention to *G. lucidum* -lingzhi or reishi mushroom), *Lentinus edodes* (shiitake mushroom), *Schizophyllum commune* (split gill), *Trametes versicolor* (turkei tail), and less-studied species like *Wolfiporia extensa*, species of genera *Tremella* and *Auricularia* (jelly mushrooms), *Armillaria mellea* (honey mushroom), *Fomitopsis ocharacea, F. mounceae, F. schrenkii, F. betulina* (birch polypore), *Laricifomes officinalis, Fomes fomentarius* (tinder mushroom), and species of genera *Russula, Lactarius,* and *Boletus* (porcini mushroom). For each mushroom, the author describes historical information, strong points, active ingredients, and health values for the treatment of various diseases, specific dosages, harvesting, processing, and uses, identification of species in the wild, habitats, and what to look for in commercial products (for example, one of the recommendations is that products should have as little starch as possible. The iodine test can be used by the consumer to check the product - unless the product has been made only from fruiting bodies, which in this case would not produce starch).

Chapter 4: "Visionary Mushrooms".

In this chapter the author reveals very intriguing current data on visionary and hallucinogen mushrooms from an ethno-mycological point of view. Hobbs provides answers to questions such as: "what are the hallucinogenic mushrooms? Who discovered hallucinogenic mushrooms: when and where? What cultures were the first to use hallucinogenic mushrooms? What was the importance of taxonomy in the study and applications of hallucinogenic mushrooms? The author also reveals data on species belonging to genus *Psilocybe*, including species identification with short descriptions. Hobbs details the discovery of psilocycin and pays particular attention to the ethno-mycological role of fly agarics *Amanita muscaria.* In this chapter the actions of hallucinogenic mushrooms in our brain are given along with how to use them in modern psychiatry. Part of this chapter is dedicated to the use of psilocybin in modern clinical research

(behavioral disorders, cancer-related anxiety and depression, neurogenesis), including clinical trials for psilocybin treatments. Here, details are also given on how to extract psilocybin from mushrooms, as well as the proper dosages, toxicity, and side effects of both groups of species of genus *Psilocybe* and *Amanita muscaria*.

Chapter 5: "Fungi in the Wild and at Home".

This chapter is dedicated to general information on where and how mushrooms grow, how to identify them, and, in some cases, how to grow them based on the author's expertise. Christopher Hobbs describes life cycles and the reproduction of fungi, details the main ecological groups (saprotrophic, parasitic, endophytic, and mycorrhizal) and identifies the specific characteristics of mushrooms. He also presents information on how to avoid poisonous species of mushrooms and pays attention to genera with both poisonous and edible species (for example, genera *Amanita, Lepiota, Lepiota, Cortinarius, Clitocybe, Inocybe,* and *Conocybe*). At the end of this chapter, the author presents different possibilities of growing mushrooms at home (outdoor and indoor cultivations).

The new book of Ch. Hobbs "Medicinal Mushrooms. The Essential Guide" are of great interest to specialists in alternative medicine, mycologists, taxonomists, biotechnologists, mushroom producers, researchers, environmentalists, ecologists, wild-crafters, scientists, medical doctors, and anyone else interested in mushrooms, especially those interested in medicinal mushrooms. The ideas, thoughts, and data in this book will help to build bridges between western and eastern medicines in the field of medicinal mushroom science in the 21st century.

Call for Papers

Aiming to build the relationship between the members and the Society, the publication of the newsletters was proposed before the launching of the Society. The newsletters represent one of the key official publications from the Society. Contents of the newsletters will include notifications of the decisions made by the committee board, reviews or comments contributed by ISMM committee members, conferences or activities to be organized, and the status updated in research, industrialization, and marketing for medicinal mushrooms. The newsletters will be released quarterly, by the first Monday of every January, April, July, and October, with possible supplementary issues as well. The Newsletter is open to organizations or professionals to submit news, comments, or scientific papers relating to medicinal mushroom research, marketing, or industry.

Contact information

For any inquiry in membership enrollment, subscribing to ISMM newsletters, upcoming activities and events organized by ISMM, or submitting news reports, statements, or manuscripts to the Society, please contact the secretariat's office in Beijing, China.

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