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MUSHROOM CHEMISTRY

Numerous studies have demonstrated that certain components present in medicinal mushrooms have been responsible for the modulation of cellular and physiological changes in the host. It is for this reason that mushrooms are often used as cancer therapeutic agents. 45,46,47 These studies used cultivated hybrid strains developed in the research labs with proprietary organic substrates. The hybrid strains and specific substrates used in these studies are not available in the wild or from most commercial mushroom growers. All of the hybrid strains of species used were cultivated in a controlled sterile environment. They are not available for the supplement or nutraceutical industry, and or as a raw food which come from the common strains of species available from commercial mushroom growers.

These hybrid strains of medicinal mushrooms in these studies contain valuable unique constituents including polysaccharides, lectins, lipids, hericenone, erinacol, erinacine, and terpenoids. Recently these components, including water-soluble polysaccharides of a specific specie of Cordyceps, were isolated from its fruit bodies and induced intriguing biological activities such as cytotoxicity, synthesis of nerve growth factor, and antimicrobial function. 45

Interleukin (IL) -1 is a pluripotent and proinflammatory cytokine that orchestrates inflammatory and host-defense responses. Biologically active IL-1b is a 17.5-kDa protein resulting from cleavage of an inactive 31_34 kDa pro-IL-1b. IL-1b augments T-cell responses to mitogens, indirectly activates B cells, increases expression of

vascular adhesion molecules, and induces other pro-inflammatory cytokines and chemokines. IL-1 is produced mainly by monocytes and macrophages when stimulated with various antigenic stimulants, including viruses or bacterial components such as lipopolysaccharide (LPS). Numerous studies have demonstrated that Lipopolysaccharide (NF0kB), activator protein 1 (AP-1), nuclear factor interleukin-6 (NF-IL6), and cAMP response element (CRE)/activating transcription factor (ATF) regulate IL-1 transcription in macrophages upon stimulations. 47

Since IL-1 is a pro-inflammatory cytokine, agents that induce the activity of IL-1 have recently gained particular therapeutic and clinical interest. Mushrooms are known for their nutritional and healthful value and also for the diversity of the bioactive compounds they contain. Protein-bound polysaccharides, designated as PSK and PSP (Polysaccharopeptide) have been isolated from certain mushrooms.

PSP is classified as a biological response modifier. It originally induced in experimental animals and now has also in human and other mammals, increased y-interferon production, interleukin-2 production, and T-cell proliferation. It also counteracts the depressive effect of cyclophosphamide on white blood cell count, interleukin-2 production and delayed type hypersensitivity reaction. Its antiproliferative activity against tumor cell lines in vivo antitumor activity has been demonstrated. A small peptide with a molecular weight of 16-18 kDa originating from PSP has been produced with antiproliferative and antitumor activities.

PSP administered to patients with esophageal cancer, gastric cancer and lung cancer, and who are undergoing radiotherapy or chemotherapy, helps alleviate symptoms and prevents the decline in immune stress.

Aspergillomarasmine A is an polyamino acid found in some of the medicinal mushroom chemistry from hybrid strains produced. The substance has been reported to inhibit two antibiotic resistance carbapenemase proteins in bacteria, New Delhi metallo-beta-lactamase 1 (NDM-1) and Verona integron-encoded metallo-beta-lactamase (VIM-2), and make those antibiotic resistant bacteria susceptible to antibiotics. Further anecdotal tests show that the Gram-negative bacterias including the new spirochetes strains in Lyme disease are resistant to antibiotics and the immune system. When consuming a dosage of 16 grams a day of these medicinal mushroom strains that have the Aspergillomarasamine A, then the resistance is removed for some. Lyme disease is an infectious disease caused by Borrelia burgdorferi, a bacterium classified as a spirochete. Further tests are being prepared to determine on a larger scale what specific Gram-negative bacterias are affected.
Gram-negative bacteria have thin walls with an outer layer composed of proteins and lypopolysacchrides. This outer layer sometimes reacts with the immune system, causing inflamation and infection. In addition to preventing the bacteria from staining the outer membrane of the cell, it also helps the bacteria resist an assortment of drugs, making treatment of infections with Gram-negative bacteria rather challenging.

Some examples of Gram-negative bacteria include Legionella, Salmonella, and E. Coli. Numerous other pathogens are also Gram-negative, including some forms of meningitis, a number of bacterial sources of gastrointestinal distress, and spirochetes. Gram-negative bacteria can be stubborn infectious agents, and many sources of lethal infection are Gram-negative, including the bacteria which contribute to secondary infections in hospitals and clinics. 50

By the term mushrooms, we generally mean the definition of Chang and Miles (1992): a macro fungus with a distinctive fruiting body which can be hypogeous or epigeous, large enough to be seen with the naked eye and to be picked by hand.

The number of mushroom species on Earth is estimated at 140,000, yet maybe only 10% (approximately 14,000 named species) are known. Mushrooms comprise a vast and yet largely untapped source of powerful new chemical and pharmaceutical products. They represent an unlimited source of polysaccharides with antitumor and immuno-stimulating properties. Data on mushroom polysaccharides have been collected from 651 species and 7 infraspecific taxa from 182 genera if higher Hetero - and Homobasidiomycetes. Mushroom polysaccharides prevent oncogenesis, show direct antitumor activity against various allogeneic and syngeneic tumors, and prevent tumor metastasis. Polysaccharides from mushrooms do not attack cancer cells directly, but produce antitumor effects by activating different immune responses in the host.

These substances are regarded as biological response modifiers. This basically means that: (1) they cause no harm and place no additional stress on the body; (2) they help the body adapt to various environmental and biological stresses; and (3) they exert a non-specific action on the body, supporting some or all of the major systems, including nervous, hormonal, and immune systems, as well as regulatory functions.

Studies show there is no chronic or acute toxicity. Cell nucleus studies show no detrimental effects and DNA showed no mutations. Pregnant animal studies demonstrated there is no detriment to fetal development, and no LD50, a measure of toxicity that has never been shown. These medicinal mushrooms apparently produce no harmful side effects.

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