Over-the-Counter Medicinal Mushrooms

by Elinoar Shavit

I AM OFTEN ASKED which medicinal mushrooms our family uses, if we select mushrooms for their flavor or for their medicinal properties, if we prefer wild mushrooms to cultivated ones, and how we preserve and prepare them. The assumption seems to be that we use mushrooms primarily for their medicinal properties and not because they are tasty, culinarily diverse, and nutritious. Rehydrated ground willow bark may lower fever but I doubt that anyone would prefer the bitter brew to a tablet of aspirin, or take a bite into a slice of moldy bread for its antibiotic properties. Mushrooms like Maitake (*Grifola frondosa*), Shiitake (*Lentinula edodes*), and other culinary medicinal mushrooms are tasty and versatile. Knowing that they are also rich in all kinds of beneficial nutrients and bioactive substances, low in calories, and can contribute to our efforts to stay healthy would seem to warrant using them often in our diet. This was our line of thought before we moved from New York City to the Boston area, when we first experienced living in the midst of New England's barrage of fall mold spores.

Soon after we moved, our daughter, then in high school, developed chronic sinus infections that would begin in the fall and linger into winter. These bouts were often followed by slow to clear lower respiratory infections. The vague diagnosis of Hypersensitivity Pneumonitis offered to describe her underlying condition did not address the havoc that a fall-to-winter course of recurrent sinusitis and bronchitis, along with courses of antibiotics and steroids, can wreak in the life of a teenager. She became progressively weaker and had to stay at home for long periods of time. We were fortunate to have the professional care that Boston's excellent medical centers could offer, but even they could not alleviate her sheer exhaustion or rid her of the incapacitating feeling of malaise. If I had to single out the most debilitating aspect of this affliction, it would be the complete exhaustion that it brought on, which prevented her from leading a normal life. Hoping that there might be something else that we could do, we asked for the advice of Dr. Andrew Weil, founder and director of the University of Arizona's Program in Integrative Medicine, and an author-

ity on the subject of complementary and alternative medicine. At the end of our conversation, Dr. Weil suggested we use Maitake, one of the better-researched medicinal mushrooms that is common in our area. He suggested that she take a daily dose of 10 grams of Maitake pieces rehydrated in boiling water. The hope was to stimulate her immune system to better deal with the infection. He cautioned that patience was required as it could take a while before any effects brought on by the Maitake would be observed.

We did not call *Grifola frondosa* Maitake in those days. We called it Hen of the Woods. Hen of the Woods was then and still is one of the culinary mushrooms we collect in large quantities each fall. It is a diverse and tasty mushroom, it keeps well when sautéed and frozen, and it is one of the best mushrooms to dehydrate and store in a sealed glass jar. It keeps dry for many years and rehydrates well, maintaining both its texture and mild (yet distinct) flavor.

We immediately began a daily regimen: we soaked 10 grams of dry Maitake pieces in a cup of water for a few hours, added some salt, a tablespoon or so of a variety of quick to wilt soup vegetables like celery, frozen carrots, peas, butter beans, corn, etc., brought this Maitake soup to a quick boil, and it was ready to eat. Our daughter ate this soup every evening, and we often made larger quantities and joined in as it was very tasty. None of us expected anything to come of it. At first, she had to use her will power to down the Maitake soup because her appetite was gone. The first thing we noticed was a gradual improvement in her appetite as she started eating better. None of us were ready for the slow but steady change in the quality of her life. Although she still had sinus infections, was still taking powerful antibiotics way too often, was on and off of steroids, and her head and body still ached, she certainly was no longer as tired as before and she was able to resume some of her favorite activities. Everyone, especially her physicians, commented on this gradual change. It became a yearly routine—about six weeks prior to fall she would start "doing the Maitake soup," and would be all too happy to drop it when winter was over. She was so fed up of the Maitake soup that we invented all kinds of ways to use this mushroom and its soaking liquid, ranging from marinated Maitake to special Maitake pastries. The trend was a clear one: if she kept up the Maitake, she felt better during her bouts with the sinus infections. When she fell off the Maitake wagon, she would get progressively sicker and exhausted. In retrospect, the difference in her general well-being between the periods of time when she was taking the Maitake or not was profound, and it was clear that it had a considerable effect on the quality of her life.

It is common knowledge that most mushrooms are rich in vitamins, fiber, and amino acids and low in fat, cholesterol, and calories. They have a wide variety of flavors, aromas, and textures, which make them culinary favorites. However, mushrooms also contain a vast variety of biologically active substances with

immunostimulatory properties, like polysaccharides (in particular β-D-glucans), proteins and triterpenoids, which improve the function of the immune system and contribute to the anticancer effects of these mushrooms.[15; 20] The reason is that most of the research evaluating the medicinal properties of mushrooms in the 20th century was done in Asia, mainly in Japan and China.[2] These countries have a tradition of using mushrooms for their health promoting and curative properties that is thousands of years old. At the time our daughter was ill, the idea of mushrooms as a source of non-toxic and effective pharmaceutical compounds that could be used as drugs within evidence-based medicine was not popular at all. Until recently, claims made about the curative powers of bioactive substances derived from edible mushrooms were dismissed or at best regarded as anecdotal.

In the past 30 years, many of the curative and health promoting properties that have been attributed to mushrooms by ancient traditional medicine practices have been validated by contemporary interdisciplinary scientific research. The production of cultivated mushrooms grew enormously in the second part of the 20th century due to the development of modern growth technologies that targeted the curative properties of mushrooms (mostly Basidiomycetes). These included better sterile techniques, better mycelium cultures, and the predictability, consistency, and high yield of the biomass of submerged cultures.[16;20] Extensive research, mostly in Japan, China, and Korea, where traditional medicines are still practiced, led to the isolation of substances found in the fruitbodies and the mycelium of fungi and provided a better understanding of the beneficial properties of these compounds. This, in turn, resulted in the development of fungi-derived compounds effective against human ailments, ranging from lowering cholesterol and regulating blood sugar levels to cancer fighting agents acting as antitumor substances and slowing metastasis.[5;20] The case of Ling Zhi, (Reishi, *Ganoderma lucidum* and closely related species), the most prominent medicinal mushroom in Traditional Chinese Medicine, is an example where science followed tradi-

tion. In Traditional Chinese Medicine, Ling Zhi is attributed with curative properties, from restoring physical and mental health and contributing to longevity, to curing cancer. In the past thirty years, over 130 highly oxygenated triterpenoids have been isolated from the fruiting bodies, spores, and culture mycelia of species of *Ganoderma*.[3] In their report about two new triterpenoids derived from *Ganoderma sinense*, Zhang and Qiu summarize that these substances include fungal steroids derived from ergosterol, (a precursor of Vitamin D_2), and substances that are known to possess a variety of bioactive properties demonstrating pharmacological activities such as antitumor, liver protective, antihypertensive, antioxidant, and anti-retroviral. They can be used in the treatment of chronic bronchitis and diabetes.[14; 20]

Presented simplistically, the human immune system comprises a collection of mechanisms that protect against diseases by identifying and killing pathogens like bacteria, viruses, and tumor cells. Compounds isolated from mushrooms were found to be immune stimulants and modulators, and effective anti-inflammatory agents.[9] A review of the research advances on the efficacy of mushroom derived polysaccharides as anticancer agents concludes that:

> Mushroom polysaccharides prevent oncogenesis, show direct antitumor activity against various syngenic 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. The antitumor action of polysaccharides requires an intact T-cell component; activity is mediated through a thymus-dependant immune mechanism. Polysaccharides activate cytotoxic macrophages, monocytes, neutrophiles, Natural Killer cells, dendritic cells, and chemical messengers (cytokines such as interleukins, interferons, and colony stimulating factors) that trigger complement-and-acute-phase responses. Also, polysaccharides can be considered as multicytokine inducers, able to induce gene expression of various immunomodulatory cytokines and cytokine receptors. (Wasser, 2007 p. 188)

In the fight against cancer, hospitals in Japan use compounds derived from mushrooms that have gone through the process of drug approval. These cellular compounds and secondary metabolites derived from edible mushrooms have a significant advantage because they are Biological Response Modifiers (BRM). BRM are compounds that stimulate the body's own response systems and mechanisms to fight disease, yet they do not harm the body or place additional stress on it. BRM are immunostimulants (they stimulate the body's response to fight all kinds of pathogens, infections, cancer, and other diseases) and adaptogens (they increase the body's own resistance to stress and trauma).[11] The bioactive constituents of *Grifola frondosa*, like those of most medicinal mushrooms, are BRM.

The main active constituents of Maitake are its polysaccharides, mainly α-glucans, β-1,3-D-glucans and β-1,6-D-glucans. Maitake can contain from 10% to 50% β-glucans in dry matter. It has proteins, vitamins B1, B2, C and Ergosterol. It also has calcium, magnesium, niacin, phosphorus, potassium, and selenium. Maitake-D-fraction, an over-the-counter immunostimulator compound derived from Maitake's β-1,3-D-glucans and β-1,6-D-glucans, made news in 1998 when the Food and Drug Administration (FDA) approved the application for Investigational New Drug (IND) from the company that produces it, Maitake Products, Inc. of New Jersey, to conduct a phase-2 clinical trial using Maitake D-fraction as an oral agent for advanced breast and prostate cancer patients. This company also developed a new medicinal mushroom preparation from Maitake (SF-Fraction-Glycoprotein), which helps maintain healthy cardiovascular functions and a healthy circulatory system. It was patented in the USA (U.S. Patent # 5,773,426). In Japan, an immunomodulator compound derived from Maitake β-glucans called Grifolan, a branched β-1,3-D-glucan extracted from *Grifola frondosa* was found to promote tumor regression and necrosis, and was approved to be used in the treatment of cancer.[7; 10]

Polysaccharides like β-1,3-D-glucans are not unique to Maitake, and have been found in other common culinary mushrooms, like Enokitake (cultivated *Flammulina velutipes*) and Shiitake. **Flammulin**, a basic protein demonstrating strong antitumor activities, was derived from Enokitake in 1963.[8] In 1968 and 1969 respectively, Chihara (et al.), and Ikekawa (et al.) reported in Japan that hot water extracts from seven edible mushrooms, including Shiitake and Maitake, showed marked host-mediated antitumor activity against cancer (Sarcoma 180).[1; 6] **Lentinan**, a protein-free polysaccharide derived from the fruitbody of Shiitake, was isolated in Japan in 1985 and was approved for the treatment of cancer, especially cancer of the stomach. Lentinan's primary polysaccharides are β-1,3-D-glucans and β-1,6-D-glucans. Lentinan, which can be taken orally, was found to be instrumental in activating macrophages to stimulate lymphocytes and other immune cell defenses (like increasing Natural Killer cells). It has also been shown to have direct antiviral activity, and was found to be effective in treating infections. Another orally active polysaccharide derived from Shiitake is **LAM**, from which a lignin-rich fraction called **JLS-18** was developed. JLS-18 has 70 times the *in vitro* antiviral activity of LEM. It activates Natural Killer cells, T cells, macrophages and Interleukin 6. Both LEM and JLS-18 have strong antitumor properties.[21]

A number of Maitake β-D-glucan supplements are available on the market, claiming to have immunostimulating and immunomodulating effects. In 2005, a study compared the immunomodulating effects of Grifton-Pro Maitake D Fraction,

which is a purified β-glucan, and Maitake Gold 404, which is a β-glucan-protein complex, to Lentinan. The study was conducted on mice, and the results were published in the *Journal of the American Nutraceutical Association*. The study looked at markers like phagocytosis, levels of monocytes, production of T-cells, Interleukin-1 and Interleukin-2, among other markers. The results showed that the Maitake derived supplements affected the immune system even when taken orally (stronger results were measured when injected), at least as well as Lentinan and in some cases even better (Lentinan was used as the control due to its well researched immunomodulating effects). The study found significant stimulation of phagocytosis, demonstrating a number of ways in which the Maitake-derived supplements affected the immune system.[19]

Some of the better researched bioactive substances found in Maitake are also found in a number of non-edible medicinal mushrooms. **Befugin**, isolated from Chaga (*Inonotus obliquus*), demonstrated antitumor activity and antioxidant properties.[17] In 1977, **PSK** (Krestin) was derived from the mycelium of Turkey Tail (*Trametes versicolor*). It was introduced in Japan as an antitumor agent. PSK acts directly on tumor cells, inhibiting the spread of cancer. It is taken orally and is approved for use in the prevention of cancer in Japan, especially cancer of the digestive organs.[18] PSK is covered by Japanese health care plans.[12;13] Among PSK's active compounds are β-1,3-D-glucans and β-1,6-D-glucans. In 1986, **SPG** (Sonifilan; Schizophyllan), was produced from *Schizophyllum commune*. SPG has shown efficacy as an antitumor agent in a number of cancers, especially cervical cancer, and its main active compounds are β-1,3-D-glucan and β-1,6-D-glucan. In Japan, cancer patients undertaking chemotherapy and radiation benefit from a treatment of **Arabinoxylane** (an active hemicellulose compound derived from the fermented mycelium of Shiitake, *Trametes versicolor*, and *Schizophyllum commune*), which was found to increase the activity of human Natural Killer cells by a factor of five in two months.[4]

Which mushrooms do we regularly consume, then, and how do we make the choice? The answer is quite simple: we follow the advice of age-old traditional medicines and look for diversity and variety in our food choices, which also include mushrooms. We enjoy the bounty of fresh wild mushrooms, each species in its season. I love morels and anxiously wait for their season to start, which is when I drop almost everything and brave ticks, brambles, and pesticide-treated apple orchards to hunt for them. Other members in our family prefer chanterelles in summer and young Maitake in fall. My eldest would trade truffles for the tender young pads of Dryad's Saddle (*Polyporus squamosus*), delicately sautéed with chives, butter, and white wine. Regularly consuming a variety of fresh and nutritious foods, including wild and domesticated mushrooms, will contribute to a healthy body and provide several thousand natural bioactive enzymes and proteins, which have been shown to support the immune system. In line with this approach, we also preserve some of our favorite species of mushrooms by drying and freezing them for use during the rest of the year. We regularly use Maitake, Shiitake, Oyster Mushrooms (*Pleurotus ostreatus*), Enokitake, wild Wood Ear (*Auricularia auricula*) and its larger cultivated cousin (*Auricularia polytricha*), Snow Mushroom (*Tremella fuciformis*), King Oyster (*Pleurotus eryngii*), and brown and white Shimeji mushrooms (*Hypsizygus marmoreus*). These medicinal mushrooms are tasty and versatile. We use stock prepared with mushrooms in many of our cooked dishes, usually using dry *Polyporus squamosus*, Maitake, Shiitake, and Chicken Mushroom (*Laetiporus sulphureus* and *L. cincinnatus*). Some of the best researched medicinal mushrooms are too tough to add to food. Mushrooms like *Ganoderma lucidum* or *Ganoderma tsugae*, *Trametes versicolor*, Chaga (*Inonotus obliquus*), or *Schizophyllum commune* can be thinly sliced and dried, and then used to prepare tea-like drinks (made even better with honey and a cinnamon stick), which can be served hot or cold. It is unfortunate that the bitter aftertaste of *Ganoderma lucidum* has recently been found to be associated with one or more of its beneficial polysaccharides.[3]

With any mushrooms we use, we get plenty of flavor and bioactive substances, and no one in our family has to force down a daily cup of Maitake soup anymore. A number of years later, I was touched to read in Dr. Weil's book *Eight Weeks to Optimum Health* (published in 1997) a paragraph that brought a retrospective smile to my face. He wrote, "My tonic of choice at the moment is an extract called Maitake D-fraction, which concentrates the immune-boosting constituents . . . and since I've been using it I almost never get colds."

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