Medicinal Mushroom
A Clinician's Overview

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• Licensed Acupuncturist (primary health care provider in California)
• Clinical herbalist
• Research scientist, UC Berkeley
• Author of Medicinal Mushrooms, other books on herbal medicine

Mushrooms as Functional Foods
• Popularity high in Asia, just beginning in Europe
• North America—mushroom extracts sold without need of approval or registration
• Most popular: shiitake, maitake, reishi, cordyceps, turkey tails; Agaricus blazei, Hypsizigus marmoreus
• Products available: mushroom mycelium powder (grown on grain, soybeans), powdered extracts in capsules or tablets; ethanolic extracts (with or without glycerin)

Health Benefits of Mushrooms
• Very little fat, no cholesterol
• Valuable mineral content; high trace minerals
• High in vitamins, especially B vitamins
• Pleurotus provides a better supply of B vitamins than any common food, except meat
• Great slimming food
• Cholesterol regulation! Shiitake, Pleurotus
• Very high in fiber—cellulose, lignan, chitin

Mushroom as Food, Green Benefits
• Highly nutritious—oyster mushroom is 25% high-quality protein; vitamins, minerals
• Turkey Tails, Trametes versicolor, produces many enzymes used for detoxing toxic sites, biobleaching of paper, etc.

Table 2
PROXIMATE COMPOSITION OF PLEUROTUS SPECIES

<table>
<thead>
<tr>
<th>Species</th>
<th>Initial moisture (g)</th>
<th>Crude protein</th>
<th>Carbohydrate</th>
<th>Fat</th>
<th>Ash</th>
<th>Energy Value [GJ]</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. ostreatus</td>
<td>92.3</td>
<td>17.5</td>
<td>10.9</td>
<td>1.9</td>
<td>9.5</td>
<td>361</td>
<td>114</td>
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<td>P. flammans</td>
<td>91.3</td>
<td>15.9</td>
<td>10.8</td>
<td>1.7</td>
<td>9.5</td>
<td>369</td>
<td>110</td>
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<td>P. tuberregius</td>
<td>91.6</td>
<td>21.6</td>
<td>13.1</td>
<td>1.6</td>
<td>9.5</td>
<td>371</td>
<td>19</td>
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<tr>
<td>P. eryngii</td>
<td>91.3</td>
<td>15.3</td>
<td>10.6</td>
<td>1.5</td>
<td>8.1</td>
<td>307</td>
<td>16</td>
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<td>P. simplicissimus</td>
<td>86.0</td>
<td>15.3</td>
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<td>1.5</td>
<td>8.1</td>
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<td>13</td>
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<tr>
<td>Agaricus blazei</td>
<td>95.5</td>
<td>25.3</td>
<td>16.9</td>
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<td>9.5</td>
<td>326</td>
<td>14</td>
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<td>Volvariella volvacea</td>
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<td>28.5</td>
<td>17.4</td>
<td>1.7</td>
<td>11.5</td>
<td>394</td>
<td>15</td>
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<td>Lentinus edodes</td>
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<td>17.5</td>
<td>10.5</td>
<td>1.5</td>
<td>8.0</td>
<td>305</td>
<td>16</td>
</tr>
</tbody>
</table>

Note: All data presented as percentage of dry weight, except initial moisture.

Table 37
ESSENTIAL AMINO ACID COMPOSITION* OF PLEUROTUS SPECIES

<table>
<thead>
<tr>
<th>Amino acids</th>
<th>F. rosea</th>
<th>P. ostreatus</th>
<th>P. tuberregius</th>
<th>P. eryngii</th>
<th>Agaricus blazei</th>
<th>Volvariella volvacea</th>
<th>Lentinus edodes</th>
<th>Hong's egg</th>
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<tr>
<td>Leucine</td>
<td>8.5</td>
<td>7.5</td>
<td>6.2</td>
<td>7.0</td>
<td>6.4</td>
<td>7.5</td>
<td>5.9</td>
<td>7.8</td>
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<tr>
<td>Isoleucine</td>
<td>5.7</td>
<td>5.1</td>
<td>4.4</td>
<td>5.0</td>
<td>4.6</td>
<td>5.4</td>
<td>4.8</td>
<td>4.8</td>
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<tr>
<td>Valine</td>
<td>8.5</td>
<td>6.9</td>
<td>5.5</td>
<td>5.3</td>
<td>2.5</td>
<td>9.7</td>
<td>3.7</td>
<td>7.1</td>
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<tr>
<td>Threonine</td>
<td>1.4</td>
<td>1.1</td>
<td>1.0</td>
<td>1.5</td>
<td>1.5</td>
<td>2.0</td>
<td>1.9</td>
<td>1.9</td>
</tr>
<tr>
<td>Lysine</td>
<td>11.2</td>
<td>11.0</td>
<td>12.0</td>
<td>11.0</td>
<td>12.0</td>
<td>11.0</td>
<td>11.0</td>
<td>11.0</td>
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<tr>
<td>Histidine</td>
<td>6.8</td>
<td>6.6</td>
<td>6.0</td>
<td>6.5</td>
<td>6.1</td>
<td>6.4</td>
<td>5.9</td>
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<tr>
<td>Phenylalanine</td>
<td>5.7</td>
<td>5.7</td>
<td>8.0</td>
<td>6.5</td>
<td>3.8</td>
<td>3.2</td>
<td>3.9</td>
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<tr>
<td>Tyrosine</td>
<td>8.4</td>
<td>8.3</td>
<td>11.3</td>
<td>9.5</td>
<td>11.0</td>
<td>11.0</td>
<td>10.0</td>
<td>10.0</td>
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<tr>
<td>Methionine</td>
<td>2.8</td>
<td>2.0</td>
<td>2.7</td>
<td>2.7</td>
<td>2.0</td>
<td>2.0</td>
<td>1.9</td>
<td>1.9</td>
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<tr>
<td>Arginine</td>
<td>6.6</td>
<td>5.2</td>
<td>6.5</td>
<td>6.2</td>
<td>6.3</td>
<td>6.1</td>
<td>5.9</td>
<td>5.9</td>
</tr>
<tr>
<td>Histidine</td>
<td>3.9</td>
<td>2.8</td>
<td>3.0</td>
<td>2.2</td>
<td>3.1</td>
<td>2.3</td>
<td>1.9</td>
<td>1.9</td>
</tr>
<tr>
<td>Total essential amino acids (excluding aspartic acid and glycine)</td>
<td>50.6</td>
<td>40.4</td>
<td>44.2</td>
<td>42.4</td>
<td>35.1</td>
<td>41.6</td>
<td>30.1</td>
<td>38.4</td>
</tr>
</tbody>
</table>

Note: nd = not determined.

* Data presented as grams of amino acids per 100 g of fresh edible protein.

For comparison.
Table 40
ESTIMATED NUTRITIVE VALUE OF PLEUROTUS SPECIES

<table>
<thead>
<tr>
<th>Species</th>
<th>Essential amino acid index</th>
<th>Biological value</th>
<th>In vivo digestibility</th>
<th>Nutritional index</th>
<th>Protein score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleurotus sower</td>
<td>95.7</td>
<td>92.7</td>
<td>89</td>
<td>16.7</td>
<td>59.7</td>
</tr>
<tr>
<td>P. flavidus</td>
<td>84.8</td>
<td>80.4</td>
<td>79</td>
<td>12.9</td>
<td>67.4</td>
</tr>
<tr>
<td>P. flavolactis</td>
<td>82.2</td>
<td>78.4</td>
<td>87</td>
<td>17.8</td>
<td>47.0</td>
</tr>
<tr>
<td>P. sajor-caju</td>
<td>70.9</td>
<td>59.2</td>
<td>63</td>
<td>14.4</td>
<td>67.6</td>
</tr>
<tr>
<td>P. eryngii</td>
<td>64.8</td>
<td>58.9</td>
<td>nd</td>
<td>13.6</td>
<td>40.0</td>
</tr>
<tr>
<td>Amanita muscaria</td>
<td>55.8</td>
<td>49.1</td>
<td>nd</td>
<td>17.0</td>
<td>43.1</td>
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<tr>
<td>Volvaria diphyllo</td>
<td>57.9</td>
<td>54.1</td>
<td>nd</td>
<td>23.1</td>
<td>58.1</td>
</tr>
<tr>
<td>Lentinus edodes</td>
<td>55.8</td>
<td>49.1</td>
<td>nd</td>
<td>9.8</td>
<td>nd</td>
</tr>
</tbody>
</table>

Notes: nd = not determined; calculations based on amino acid analysis listed in Table 37.

* Using egg as reference protein.

Table 60
BIOLOGICAL CONVERSION EFFICIENCY AND PROTEIN YIELD BY DIFFERENT MUSHROOMS

<table>
<thead>
<tr>
<th>Mushroom</th>
<th>Biological conversion efficiency</th>
<th>Protein content (g/kg dry substrate)</th>
<th>Protein yield (g/kg dry substrate)</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleurotus sower</td>
<td>100</td>
<td>22.5</td>
<td>22.5</td>
<td>275</td>
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<tr>
<td>Agaricus campestris</td>
<td>70</td>
<td>26.3</td>
<td>18.4</td>
<td>264</td>
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<tr>
<td>Volvaria diphyllo</td>
<td>15</td>
<td>22.5</td>
<td>24</td>
<td>262</td>
</tr>
<tr>
<td>Coriolus versicolor</td>
<td>15</td>
<td>22.5</td>
<td>7.9</td>
<td>122</td>
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</table>

Note: Data calculated on dry weight basis; nd = not determined.

Table 29
DIETARY FIBER (DF) CONTENTS IN FRUIT BODIES

<table>
<thead>
<tr>
<th>Species</th>
<th>Cellulose</th>
<th>Hemicellulose</th>
<th>Total DF*</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. comestis</td>
<td>17.6</td>
<td>24.5</td>
<td>46.0</td>
</tr>
<tr>
<td>P. estrews</td>
<td>11.6</td>
<td>27.8</td>
<td>47.5</td>
</tr>
<tr>
<td>Tricholoma venezuelense</td>
<td>12.1</td>
<td>18.2</td>
<td>40.6</td>
</tr>
<tr>
<td>Lentinus edodes</td>
<td>12.0</td>
<td>22.2</td>
<td>37.5</td>
</tr>
<tr>
<td>Agaricus leporinus</td>
<td>11.1</td>
<td>15.0</td>
<td>29.9</td>
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</tbody>
</table>

* The total dietary fiber is the sum of neutral detergent fiber and pectic substances.

Table 42
COMPARISON OF NUTRITIVE VALUE OF PLEUROTUS WITH VARIOUS FOODS

<table>
<thead>
<tr>
<th>Essential amino acid index</th>
<th>Nutritional index</th>
<th>Protein score</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 — Pork, chicken, beef</td>
<td>59 — Chicken</td>
<td>100 — Pork</td>
</tr>
<tr>
<td>99 — Milk</td>
<td>43 — Beef</td>
<td>98 — Chicken, beef</td>
</tr>
<tr>
<td>91 — Potato, kidney beans</td>
<td>35 — Pork</td>
<td>91 — Milk</td>
</tr>
<tr>
<td>90 — Pleurotus (high)</td>
<td>31 — Soybeans</td>
<td>67 — Pleurotus (high)</td>
</tr>
<tr>
<td>88 — Corn</td>
<td>26 — Spinach</td>
<td>63 — Cabbage</td>
</tr>
<tr>
<td>86 — Cucumber</td>
<td>24 — Kidney beans</td>
<td>53 — Pleurotus</td>
</tr>
<tr>
<td>79 — Peanuts</td>
<td>20 — Peanuts</td>
<td>50 — Corn</td>
</tr>
<tr>
<td>72 — Cabbage</td>
<td>17 — Pleurotus (high)</td>
<td>46 — Kidney beans</td>
</tr>
<tr>
<td>69 — Tomatoes</td>
<td>14 — Cucumbers</td>
<td>43 — Pleurotus (low)</td>
</tr>
<tr>
<td>67 — Pleurotus (low)</td>
<td>14 — Tomatoes</td>
<td>45 — Pleurotus (low)</td>
</tr>
<tr>
<td>55 — Carrots</td>
<td>11 — Carrots</td>
<td>51 — Carrots</td>
</tr>
<tr>
<td>44 — Tomatoes</td>
<td>10 — Tomatoes</td>
<td>28 — Spinach</td>
</tr>
<tr>
<td>10 — Peanuts</td>
<td>9 — Peanuts</td>
<td>23 — Soybeans</td>
</tr>
<tr>
<td>8 — Carrots</td>
<td>6 — Carrots</td>
<td>18 — Tomatoes</td>
</tr>
</tbody>
</table>

Mineral Content of Fungi

<table>
<thead>
<tr>
<th>Species</th>
<th>Cu</th>
<th>P</th>
<th>K</th>
<th>Fe</th>
<th>Cd</th>
<th>Zn</th>
<th>Ca</th>
<th>Pb</th>
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<tr>
<td>Pleurotus sower</td>
<td>23</td>
<td>1410</td>
<td>4510</td>
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<td>0.4</td>
<td>82.7</td>
<td>17.8</td>
<td>1.5</td>
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<td>P. flavidus</td>
<td>24</td>
<td>1830</td>
<td>6000</td>
<td>184</td>
<td>0.5</td>
<td>112.4</td>
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<td>1.5</td>
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<td>P. flavolactis</td>
<td>34</td>
<td>1500</td>
<td>3540</td>
<td>134</td>
<td>0.5</td>
<td>58.6</td>
<td>71.9</td>
<td>1.4</td>
</tr>
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<td>P. sajor-caju</td>
<td>20</td>
<td>760</td>
<td>3260</td>
<td>124</td>
<td>0.3</td>
<td>129.0</td>
<td>12.2</td>
<td>3.2</td>
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<tr>
<td>P. eryngii</td>
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<td>1348</td>
<td>2970</td>
<td>182</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>ad</td>
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<tr>
<td>Agaricus campestris</td>
<td>23</td>
<td>1820</td>
<td>4762</td>
<td>186</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
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<td>38</td>
<td>1020</td>
<td>3333</td>
<td>177</td>
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<td>nd</td>
<td>nd</td>
<td>nd</td>
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<td>Lentinus edodes</td>
<td>418</td>
<td>650</td>
<td>1296</td>
<td>390</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
<td>nd</td>
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<tr>
<td>Straw substrate*</td>
<td>87</td>
<td>1200</td>
<td>1372</td>
<td>0.4</td>
<td>20.7</td>
<td>21.9</td>
<td>3.5</td>
<td></td>
</tr>
</tbody>
</table>

Note: Data calculated on dry weight basis; nd = not determined.

Mushrooms as medicine

- Medicine—approved drugs in Japan, China for cancer treatment adjuvants (with chemo)
- Health supplements to support immunity
Biological Activity of Fungi

- All fungi and yeasts have triple helix polysaccharides (beta-glucans) in cell walls
- Heat breaks down chitin, exposes active molecules
- Binding of large molecular weight fungal compounds to gut receptors (60% of total)
  - complex immune activation
  - Dectin, other receptors

Some Possible Indications

- Shiitake for immune weakness, infections
- Shiitake, Turkey Tails for Cancer
- Viral Syndromes: Hepatitis C, herpes, HIV
- Cordyceps for fatigue, performance, “adaptogen,” antiaging supplement
- Reishi for insomnia, anxiety, nervous system disorders related to stress
- Reishi for respiratory problems

Research Summary

- More than 270 recognized species of mushrooms are known to have specific immunotherapeutic properties
- Fifty nontoxic mushrooms species yielded potential immunoceuticals in vitro
- Six species have been studies in human cancers
  
J Society Integr Oncol. 2008 Summer; 6(3): 122–128

Therapeutic Use—Questions!

- Mushroom products widely used, many countries
- Important questions
  - Whole mushrooms or isolated constituents?
  - Smaller pieces of heteroglucans active? Alcohol, heat, Hcl all reduce size of initial compounds
  - Fruit body, or mycelium more effective?
  - Fresh vs. dry
  - Dose—too high a dose can lead to immune suppression, not high enough, immune activation may be incomplete
**More Questions Clinical, Personal Use**

- **Common Questions**
  - Substrate: host species varies for most polypores
  - Specific scope of indications?
  - Duration of treatment? Will immune activation decrease with time?
  - For cancer, more effective with radiation or chemotherapy? Or alone?
  - Integration into modern health care—controlled studies are needed

**Conclusion**

- More controlled human clinical trials needed
- Mushroom extracts are effective for counteracting some harmful effects of chemo and radiation
- Counteract immune suppression
- Mushroom extracts can lead to increased survival times and improved quality of life
- Preliminary published research, as well as clinical reports show effectiveness for hepatitis C and other viral syndromes

**Traditional Chinese Medicine**

- Historical medical use in Asia is often based on the precepts of traditional Chinese medicine (TCM)
- Mushroom species are often added to soups, traditional foods and eaten regularly for immune support, other healing qualities (over 3,000 years)
- Often added to prescriptions to treat “deficiency” or xu conditions of Kidney, Heart, Lung, Spleen systems

**Traditional Chinese Medicine II**

- Most common species added to prescriptions include
  - Hoelen, fuling (Wolfiporia cocos)
    - Tonify Spleen system (digestion), remove excess water, counteract fatigue, improve immune status
  - Zhuling (Grifola umbellata)
    - Diuretic herb, remove excess water (edema), cancer
  - Ling zhi (Ganoderma lucidum)
    - Calm “spirit,” for disturbed “shen,” respiratory ailments, panacea
  - Dong Chong Xia Cao (Cordyceps sinensis)
    - Exhaustion, sexual debility, to build “essence”

**Most Clinically-Relevant Medicinal Mushrooms**

- *Lentinus edodes*  
  - Shiitake

- *Trametes versicolor*  
  - Turkey tails

- *Ganoderma lucidum*  
  - Reishi

- *Grifola frondosa*  
  - Maitake

- *Wolfiporia cocos*  
  - Hoelen, Fuling

- *Pleurotus spp.*  
  - Oyster mushroom

- *Cordyceps sinensis*  
  - Dong chong xia cao

- Other interesting species: *Agaricus blazei*, *Tremella fuciformis*, *Inonotus obliquus*, *Heiricium***

**Trametes versicolor**  
*Turkey Tails*

- Ubiquitous polypore on nearly every continent
- Delignifies many hardwoods, especially oaks; fruit trees
- Prescription drugs in Japan for treatment of cancer with purified protein-polysaccharide complexes (PSP; PSK)
**Trametes versicolor**
Turkey Tails

**Stereum spp.**
False Turkey-Tails

- Zoned, hairy cap
- Turkey tails: rough, white pore surface
- Stereum: smooth orange pore surface
- Grow in similar habitats on hardwoods

**Trametes versicolor**

Summary of *Trametes versicolor* cancer Clinical Trials Conducted in Asia

<table>
<thead>
<tr>
<th>Type of Cancer</th>
<th>No. of RCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stomach</td>
<td>21-RCTs, N = 13,498</td>
</tr>
<tr>
<td>Colorectal</td>
<td>9 RCTs, N = 2,194</td>
</tr>
<tr>
<td>Esophageal</td>
<td>3 RCTS, N = 532</td>
</tr>
<tr>
<td>Breast</td>
<td>4 RCTs, N = 2,217</td>
</tr>
</tbody>
</table>


**PSK, PSP**

- PSK, PSP; crude extracts from *T. versicolor*
- prepared from strain CM-101 of *Tv* by water extraction
- 62% polysaccharide and 38% protein
- proteoglycan molecules bioavailable orally
- Bioactive molecules found in bone marrow, salivary gland, brain, liver, spleen, pancreas, and tumor tissue within 24 hours (*in vivo*)

**Trametes versicolor**
most-studied

- One medicinal mushroom, *Tv*, has been studied in phase I, II, and III randomized clinical trials
- Stomach, colorectal, esophageal, and breast cancer patients
- Japanese and Korean clinical data provide support for the hypothesis that immunomodulation can influence the clinical course in various cancers
- Meta-analysis in 1,094 colorectal cancer patients, all showing a positive impact on clinical outcomes (*Sakamoto et al*, 2006)
Mushroom Research in U.S.

Bastyr University and University of Minnesota

2.4 million awarded for explore the feasibility for use of mushroom extracts as immunomodulating agents

Trametes Versicolor in Women with Breast Cancer

- Phase II randomized-placebo controlled trial of a mushroom extract (Trametes versicolor or Tv)
- Women with early stage breast cancer who have completed adjuvant radiation therapy
- Immune recovery—enhanced natural killer cell activity, etc.
- Self-reported quality of life/ fatigue scores
- On-going research for Breast, Prostate Cancer re-funded, 2011

Trametes versicolor mushroom immune therapy in breast cancer

- “Data from multiple epidemiologic and clinical studies … suggest that immune function has a role in breast cancer prevention.”
- “Immune therapy utilizing the polysaccharide constituents of Trametes versicolor (Tv) as concurrent adjuvant cancer therapy may be warranted as part of a comprehensive cancer treatment and secondary prevention strategy.”

Trametes versicolor Clinical Indications

- **PSK:**
  - Cervical, gastric cancers, carcinoma of nasopharynx
  - Glomerulonephritis, sarcoidosis, idiopathic nephrotic syndrome, lupus, chronic rheumatoid arthritis (Immune enhancement and improved clinical outcomes with such diseases)
  - Fewer outbreaks of genital herpes (increased cellular immunity)
  - Hyperlipidemia (reduced LDL levels in stage IIa)
- **PSP:**
  - Cancers of the esophagus, stomach, and lung (controlled, 3 g/day p.o.) with chemo- and radiation therapies: less side effects including anorexia, fatigue, pain; higher body weight; improved immune status.
  - Esophageal cancer: higher remissions with PSP and chemo (72% vs. 42% on chemo alone)

Trametes versicolor Dose, Side Effects

- **Dose:** 3-6 grams/day orally; i.v. administration
- **Toxicity** low, few reported side effects, even with i.v. administration.
- **Negative results** were found on the Ames and chromosome distortion tests

Lentinus edodes Shiitake

- **Xiang gu or “fragrant mushrooms”** of Chinese cuisine
- **Second most widely cultivated mushroom**
- **Most published scientific studies**

Fruiting body of shiitake on oak

Lentinus edodes

- **Biological Effects**
  - Immunomodulating
  - Antitumor, anticarcinogenic
  - Antiviral
  - Hepatoprotective
  - Antiulcerogenic
  - Anticholesterolemic
**Lentinus edodes**

**Clinical Trials**

- Clinical trials summary
  - Numerous Chinese, Japanese clinical trials with LEM + chemo for various cancers
    - 5-year survival rate is up to 30% higher with LEM over placebo
  - Antitumor effect, increase survival time for patients with inoperable gastric cancer; with breast cancer (lentinan)
  - Best results seen in phase III trial when lentinan was administered

**Summary of indications**

- AIDS/HIV
- Hepatitis C, B (chronic)
- Cancer (prevention, treatment (often with chemo, radiation))
- Hypercholesterolemia
- Chronic fatigue, viral syndromes
- Immune suppression
- Infectious diseases

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**Ganoderma lucidum**

**Reishi, Ling Zhi (antler form)**

- Ling zhi celebrated in ancient Chinese art
- Revered for several thousand years to treat liver disease, nervous system disorders, respiratory tract infections
- Modern research shows immunomodulating, anticancer effects

**Biological Effects**

- Analgesic (antineciceptive)
- Antiallergic, antihistimine
- Antiinflammatory
- Antibacterial
- Antioxidant
- Antitumor, antimutagenic
- Antiviral (HIV, others)
- Antihypertensive
- Immunostimulating
  - Enhances bone marrow nucleated cell proliferation
  - Enhanced NK cell activity
  - Interleukin-1, -2 production
  - Increase in WBC production
- Cardiotoxic
- Antithrombotic (G. japonicum)
- Central depressant, peripheral anticholinergic
- Expectorant, antitussive
- Adrenocortical functions
- Hepatoprotective
- Protection against ionizing radiation
- Antiulcer

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**Ganoderma lucidum**

**Traditional Indications, Dose**

- Calms the spirit, augments the Heart qi, and tonifies the Heart blood: for insomnia, fright and palpitations, and forgetfulness associated with insufficient Heart qi and blood
- Failing to nourish the spirit. Can be used as a stand-alone herb for this purpose
- Deficiency consumption, cough, wheezing, insomnia, and poor digestion

**Ganoderma applanatum**

**Artist’s Conk**

- Common worldwide on hardwoods
- Pore surface turns brown when scratched
- Hepatoprotective effect in patients with post-hepatitis cirrhosis or chronic hepatitis B

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**Ganoderma lucidum**

**Traditional Indications, Dose**

- **PROPERTIES** sweet, neutral
- **CHANNELS ENTERED** Heart, Liver, Lung
- **KEY CHARACTERISTICS** calms the spirit while augmenting the qi and nourishing the blood
- **DOSAGE** 3–15g in decoctions; 1.5-3g in pills and powders
- **CAUTIONS & CONTRAINDICATIONS** Use with caution in patients with excessive conditions.

According to Bensky et al,

**Ganoderma lucidum**

**Clinical Indications**

- Anti-aging, antioxidant effect
- Adjuvant for cancer treatment protocols
- Nervous system disorders: neurasthenia, dizziness, insomnia (deficiency types—spirit or “shen” disturbance)
- Mental diseases, alzheimer’s disease
- Rhinitis, bronchitis, other chronic URIs; respiratory allergies
- Duodenal ulcers
- Hyperlipidemia
- Diabetes
- Hepatitis

**Therapeutic Dose:** 3-12 grams fruiting body powder; 3-5 g powdered extract

**Ganoderma applalatum**

**Clinical indications**

- Urinary, respiratory tract infections
- Tuberculosis
- Esophageal cancer
- Post-hepatic cirrhosis
- Chronic active hepatitis

**Biological effects:**

- Immunostimulating
- Antitumor activity against sarcoma 180, other tumors in mice
- Substance with interferon-like properties induced from mouse spleen cells

**Ganoderma sinense**

**Traditionally used to treat**

- Urinary, respiratory tract infections
- Tuberculosis
- Esophageal cancer
- Post-hepatic cirrhosis
- Chronic active hepatitis

**“Improves the complexion, increase agility, and imparts longevity”**

- Analgesic and antiinflammatory activity in arthritis models in mice
- Mycelial extract promotes phagocytosis

**Ganoderma tsugae**

- Fruiting bodies grow on old hemlocks
- Song shan ling zhi (pine tree fungus)
- Widely-cultivated in Taiwan

**Triterpenoids, lucidone A, ganodermic acid B, and ganoderic acid C2 also in G. lucidum**

- Hepatoprotective activity in mice
- Antitumor effect
- Increased serum interferon levels and augmented splenic NK cell activity in mice, i.p.
**Ganoderma curtisii**
- Yellow and orange-capped species
- Grows in se U.S.

**Grifola frondosa**  
**Maitake**
- Highly regarded in Japan where people “danced” with joy when they found it
- Prized as an edible in Europe, North America, Asia
- Clinical studies sparse
- Heavily promoted in N.A. and Asia as a dietary supplement

**Grifola frondosa**  
**Clinical Indications, Dose**
Supportive treatment for:
- Hypercholesterolemia
- Hypertension
- Cancer, especially bladder cancer
- Hepatitis
- Non insulin dependent diabetes, blood sugar imbalances

Therapeutic dose:
- 2 grams watery extract powder, 3 x daily
- 3-12 grams powdered fruiting body

**Grifola frondosa**  
**Clinical Trials**
Controlled
- After an average follow-up of 71 months in 146 patients with bladder cancer treated by partial cystectomies, the recurrence rate was 33% compared with 65% for controls (*G. frondosa, zhu ling)*

**Wolfiporia cocos**  
**Hoelen, Fuling**
- One of the most widely-prescribed herbal drugs in traditional Chinese medical prescriptions
- Sliced and dried mushroom tuber or “sclerotium” or the skin is used in traditional medicine
- The fungus infects the roots and stumps of pine and other conifers
- Range: eastern Asia, e. Australia, se North America, Africa
- Used for food and medicine in Nigeria

**Wolfiporia cocos**  
**Clinical Trials**
- No clinical trials on *W. cocos* alone.
- Clinical reports: used to treat cardiac arrhythmias
- Decoction of the skin studied in China for treating coughs, edema, as a diuretic.
- Used as an abortifacient in Korea
**Wolfiporia cocos**

**Clinical Indications, Dose**

- In traditional Chinese medicine
  - Increases urine output, clears dampness; difficult urination, diarrhea, edema due to fluid stagnation
  - Symptoms such as anorexia, diarrhea, abdominal distention (due to Spleen Qi deficiency and dampness)
  - Symptoms such as palpitations, headache, dizziness due to phlegm congestion
  - Heart palpitations, insomnia, headache, dizziness due to disturbance of the “Heart system” or shen (spirit)

Dose: 9-15 grams up to 60 grams; 2-4 grams extract

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**Cordyceps sinensis**

**Clinical Trials**

Controlled:
- Positive effects on hyperlipidemia compared with controls
- Reduced aminoglycoside nephrotoxicity in elderly patients in a small (n=21) trial.

Uncontrolled:
- Reduction of cyclosporin nephrotoxicity in kidney-transplant recipients.

- Positive effects on hyperlipidemia compared with controls
- Reduced aminoglycoside nephrotoxicity in elderly patients in a small (n=21) trial.
- Reduction of cyclosporin nephrotoxicity in kidney-transplant recipients.

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**Cordyceps sinensis**

**Clinical Indications, Dose**

- In convalescence
- Antiaging
- Immunosuppression
- Asthma, bronchial and lung inflammation
- Adjuvant in protocols for treating cancer
- Nephritis; nephrotoxicity in kidney-transplant patients induced by cyclosporin
- Nephrotoxicity in elderly patients
- Hyperlipidemia

- Therapeutic dose: 3-10 grams 3x/day mycelium grown on grain or soy; 3-12 grams/day watery extract; 1-2 ml, 3x daily ethanolic extract

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**Cordyceps sinensis**

**Biological Effects**

- Cardioprotective, in vivo
  - Positive inotropic and negative chronotropic effects, relaxation of aorta and bronchus (in vitro)
  - Inhibition of thrombi formation and platelet aggregation
- Bronchodilation
- Sedative, hypnotic
- MAO-inhibition
- Antibacterial
- Enhancement of liver ATP status in liver

- Immunostimulating actions, in vivo
  - Increased macrophage activity
  - Significantly increased survival span with lymphoma, in vivo
  - Increased platelet production
  - Stimulation of B-lymphocytes
  - No effect on humoral immunity
  - Methanolic extract suppressed IL-1beta, IL-6, TNF-alpha, and IL-8 cytokines
  - Modulated TH1 and TH2 cell functions in bronchial airway
  - Increases survival time of mice with lupus

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**Cordyceps sinensis**

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  - Inhibition of thrombi formation and platelet aggregation
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- Sedative, hypnotic
- MAO-inhibition
- Antibacterial
- Enhancement of liver ATP status in liver
**Cordyceps Traditional Indications, Dose**

- **PROPERTIES** sweet, warm
- **CHANNELS ENTERED** Lung, Kidney
- **KEY CHARACTERISTICS** gently tonifies the Kidney yang, augments the essence, tonifies the Lungs, settles coughs and wheezing, stops sweating
- **DOSAGE** 3-9g
- **CAUTIONS & CONTRAINDICATIONS** Use with caution in those with exterior conditions.

**Oyster Mushroom**

- **Pleurotus ostreatus**
  - Widely cultivated, 3rd most commonly available in markets
  - Grows on alder, tanbark oak; other hardwoods
  - Cholesterol-lowering properties

**Pleurotus ostreatus**

- **Biological Effects**
  - **Antihyperlipidemic**
    - Total cholesterol fell up to 33%, also LDL, VLDL, triacylglycerol, but not HDL (5% of diet in rats, rabbits)
    - Mevinolin, crude form of Lovastatin found in Pleurotus cultures (>23 mg/100 mL)
    - Mushroom extract inhibits HMG CoA reductase
  - **Antitumor**
    - Inhibits colon cancer in rats (15% of diet)
    - Natural killer cell (NK) and lymphokine-activated killer (LAK) cells attacked tumor cells

**Pleurotus ostreatus**

- **Clinical Indications**
  - **Clinical indications**
    - Hypercholesterolemia (2 g/kg/day = 4 ounces/day)
    - Reduction of colon cancer risk, other cancers (with significant amount in diet—up to 15%, 5% showed few benefits)
  - Dose: mushroom powder: up to 120 grams (4 ounces)/day in diet
  - **Side Effects, Contraindications**: rarely, contact dermatitis

**Schizophyllum commune**

- **Split-Gill**
  - Tumor-reducing extract called schizophyllan is produced in Japan

**Schizophyllum commune**

- **Biological Effects**
  - **Antitumor**
  - Restores natural killer cell activity to normal in mice with cancer
  - Increases resistance against bacterial infection
  - Good protective effects against damage of the bone marrow against chemotherapy
**Schizophyllum commune**

**Clinical Trials**

- Survival rates significantly increased in studies of 367,323 patients with gastric cancers when given with chemo and/or radiation
- Better 5-year survival rates in women with stage II cervical cancer when given with radiation therapy, along with stronger T-helper cell activity and improvements in other immune functions
- Open trial showing benefits in 11 patients with chronic fatigue syndrome

**Clinical Indications**

- Gastric cancer (with chemotherapy and radiation)
- Cervical cancer
- Oral carcinoma
- Hepatitis B (theoretical), chronic fatigue syndrome
- Infectious diseases
- In traditional Chinese medicine:
  - leucorrhea
- Dose: 9-16 g in decoction, 3X/day

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**Armillaria mellea**

- Honey mushroom attacks live hardwoods, including fruit trees
- Massive mycelial networks cover many acres, one of Earth’s oldest living organisms

**Clinical indications**

- Hypercholesterolemia
- Anticonvulsant
- Leg pain, epilepsy
- Improve night vision
- Increases blood flow to brain: dizziness, insomnia, neurasthenia, tinnitus
- Dose: fruit body, 30 gr; tincture, 1-3 ml (b.i.d.)
- Contraindications, Side Effects: don’t exceed recommended dose; diarrhea

**Clinical trials**

- Open trials: reduces hypertension, benefits neurasthenia
- In vitro, in vivo studies
  - Antibacterial, antifungal
  - Antitumor effects
  - Decreases heart rate, reduces peripheral arterial resistance, increases coronary oxygen efficiency

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**Fomes officinalis** — *Quinine Conk*

- “Panacea mushroom of the ancient Greeks
- Major ingredient of Mithridate, Warburg tincture
- “Quinine conk” in the early U.S.; shot from trees with rifles for sale as quinine substitute

**Clinical indications**

- Panacea according to Dioscorides, Gerard
- Hypercholesterolemia
- Toxemia
- Constipation
- Antimalarial
- Brochial asthma
- Night sweats
- Dose
  - 3-5 grams/day decoction, 1-2 ml tinc.

**Clinical trials**

- none
- In vitro, in vivo studies
  - Antitumor
  - CNS depression in high doses
**Inonotus obliquus**  
*Chaga*
- Sterile conk that grows on yellow birch in NE U.S., NE Europe, Russia
- May protect tree after injury
- Absorbs betulinic acid, an antitumor compound

**Inonotus obliquus**
- Studies show antitumor, anticancer effect
- Some clinical trials from Russia show benefit in cancers
- Common on yellow birch in NE Vermont, NY

**Ustilago maydis**  
*Corn Smut, Cuitlacoche*
- Grows on corn kernels
- Delicacy in Mexican cooking
- Similar, but much milder action than ergot
- Contains uterine-contracting alkaloids
- Official in the USP
- Uses: postpartum bleeding, partus preparator
- Dose: 1-3 ml

**Auricularia auricula**  
*Wood Ear*
- *Auricularia polytricha* is used interchangeably according to the Pen T’sao
- Used in Chinese cooking
- In Europe, wood ear was boiled to treat throat inflammation, eye irritation
- Biological effects: antitumor, ant ulcer effect, hypocholesterolemic, antidiabetic, beta-cell protective effect, antioxidant, antiageing

**Auricularia auricula**  
*Wood Ear*
- Uses in TCM:
  - Moves blood, stops pain
  - Increases physical, mental energy
  - Slows excessive uterine bleeding
  - Eases abdominal pain
  - Low back pain
  - Debility after childbirth
  - Muscle spasms
  - Poor circulation
  - Clears phlegm, strengthens lungs

**Boletus edulis**  
*King Bolete, Porcini*
- Delicious mushroom on all continents
- Cancer-protective effect
Fomitopsis pinicola
Red-Belted Polypore

- Common polypore on conifers, especially Douglas fir
- Paste applied to wounds
- Kings: intermittent fevers, chronic diarrhea, neuralgia, nervous headaches, excessive urination, jaundice, fevers of tuberculosis

Amanita muscaria
Fly Agaric

- Mother tincture used homeopathically for epilepsy

Death Cap
Amanita phalloides

- Contains 2 kinds of liver toxins; destroys liver cells; possibly deadly
- Milk thistle has reduced death rate to 0 in Europe
- CDC has refused to use it in the U.S.

Silybum marianum

- Used in China in “Tendon-Easing Pills”

Piptoporus betulinus
Birch Polypore

- Grows in eastern hardwood forests on birch
- Some immuno-modulating effects shown
**Pycnoporus cinnabarinus**  
Cinnabar Polypore

- Used in the Amazon and SE Asia in medicinal teas