Reishi Mushroom: An Exploration of Ethnomycology, Current World Research, and Use in Clinical Applications

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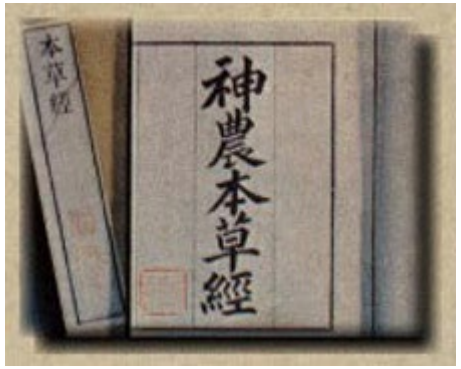
Shennong – (The Divine Farmer) legendary founder of Chinese Medicine
Lived circa 2737 B.C.E. to 2697 B.C.E.



Earliest recorded history of Reishi in herbal medicine is from *Shennong Bencao Jing* (Herbal Classic of Shennong) published circa 500 AD

Ganoderma is called Immortal Weed and is considered the top Echelon of herbal medicines – referred to as a superior tonic

6 Types of Ganoderma referenced in *Shennong Bencao Jing*

1. Dragon Ganoderma – Long Zhi. Sour and Balanced. "Brightens the eyes, supplements the liver qi, Quiets the essence and Ethereal soul, cultivates humanity and compassion"

2. Cinnabar Ganoderma– Chi Zhi. Bitter and Balanced. "Boosts heart qi , supplements the center, Sharpens the wits, Improves memory"

3. Gold Ganoderma – Lin Zhi. Sweet and Balanced. "Treats the five evils in heart and abdomen, boosts the spleen qi, Quiets the spirit, and cultivates loyalty, honesty and gentleness"

4. Jade Ganoderma – Yu Zhi. Acrid and Balanced. Mainly treats cough and boosts the lung qi, "disinhibits the mouth and nose, fortifies the will to cultivate bravery and undauntedness, and quiets the corporeal soul".

5. Ganoderma Pupurea – Zi Zhi. Salty and Balanced. "Treats urinary dribbling block, disinhibits the water passageways, boosts the kidney qi, frees the nine orifices, and sharpens the hearing"

6. Wood Ganoderma – Mu Zhi. Sweet and Warm. "Treats deafness, disinhibits the joints, protects the spirit, boosts the essence qi, fortifies the sinews and bones, and renders a good facial complexion.

Protracted (long term) use of all 6 types "make the body light, prevent senility, and prolong life as to **make one immortal.**

Ganos – brightness or sheen
Derma - skin


Ganoderma
applanatum


Ganoderma tsugae

Which one is the real Ling Zhi?

“Ling Zhi for sale!”

Picture from a market in Shanghai

Will the real Mushroom of Immortality be revealed?

Elucidating "lucidum": Distinguishing the diverse laccate Ganoderma species of the United States

A. L. Loyd , C. W. Barnes , B. W. Held , M. J. Schink , M. E. Smith , J. A. Smith , R. A. Blanchette

Published: July 18, 2018

Abstract

Ganoderma is a large, diverse and globally-distributed genus in the Basidiomycota that includes species causing a white rot form of wood decay on a variety of tree species. For the past century, many studies of Ganoderma in North America and other regions of the world have used the name G. lucidum sensu lato for any laccate (shiny or varnished) Ganoderma species growing on hardwood trees or substrates. Molecular studies have established that G. lucidum sensu stricto (Curtis) Karst is native to Europe and some parts of China. To determine the species of the laccate Ganoderma that are present in the United States, we studied over 500 collections from recently collected samples and herbarium specimens from hardwoods, conifers, and monocots. A multilocus phylogeny using ITS, tef1α, rpb1 and rpb2 revealed three well-supported clades, similar to previously reported findings. From the U.S. collections, thirteen taxa representing twelve species were identified, including: G. curtisii, G. lucidum sensu stricto, G. martinicense, G. oregonense, G. polychromum, G. ravenelii, G. sessile, G. tsugae, G. tuberculosum, G. cf. weberianum, G. zonatum, and Tomophagus colossus (syn. G. colossus). The species G. meredithiae is synonymized with G. curtisii, and considered a physiological variant that specializes in decay of pines. The designation G. curtisii f.sp. meredithiae forma specialis nov. is proposed. Species such as G. curtisii and G. sessile, once considered as G. lucidum sensu lato, were found to be divergent from one another, and highly divergent from G. lucidum sensu stricto. Morphological characteristics such as context tissue color and features (e.g. melanoid bands), basidiospore shape and size, geographic location, and host preference were found to aid in species identification. Surprisingly, G. lucidum sensu stricto was found in the U.S., but only in geographically restricted areas of northern Utah and California. These collections appear to have resulted from the introduction of this species into the United States possibly from mushroom growers producing G. lucidum outdoors. Overall, this study clarifies the chaotic taxonomy of the laccate Ganoderma in the United States, and will help to remove ambiguities from future studies focusing on the North American species of laccate Ganoderma.

How to *sort of* Harvest Reishi
Bloopers Edition

*Remember to pack citronella oil in backpack to repel bugs

*AKA Varnish Conk (not Varnish Cap)

*there are 7 fruiting bodies on tree

*”that would not be ethical”

* (DSHEA compliant language so the FDA does not fine me)

*This was not a great knife (use a sharper knife like a buck knife)

*Sacrifice husband in the name of science

*USE A SHARPER KNIFE!!

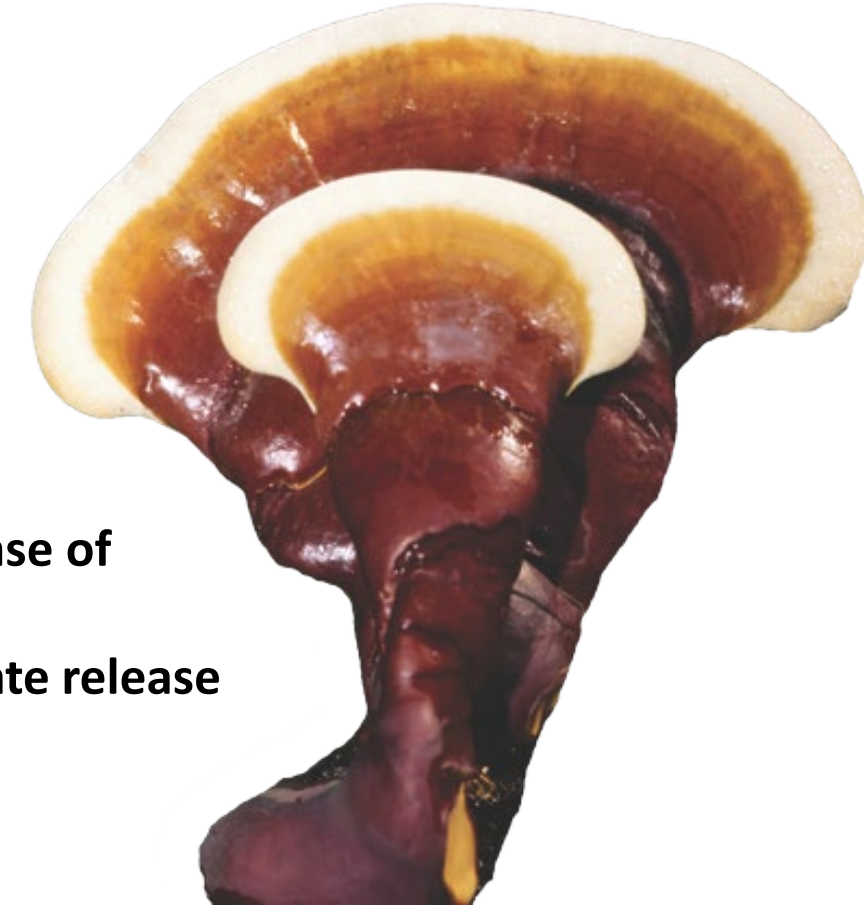
* What species am I talking about again?

*Remember to pack selfie stick in backpack

* Be a backseat forager

* Nail the ending of the video

Reishi's "Star Constituents"



Polysaccharides - hydrophilic

- **β-D-glucans, α-D-glucans, α-D-mannans and polysaccharide-protein complexes**
- **To date, more than 200 unique polysaccharides have been isolated from *G. lucidum* fruit bodies, spores, and mycelia or from liquid cultures**

Triterpene Compounds – hydrophobic

- **Steroid-like compounds that modulate the release of inflammatory cytokines**
- **Support balanced blood fats, impact BP, modulate release histamine, adaptogenic**
- **To date, more than 300 unique triterpenes identified**

Sterols – hydrophobic

- **Ergosterols – pro-vitamin D**
- **Lanosterol – serves as hormone precursor**

Minerals : potassium, calcium, phosphorus, magnesium, selenium, iron, zinc, and copper

- **Antioxidants :** Ergothioneine, Phenolic antioxidants

Ganoderma Triterpenoid Compounds

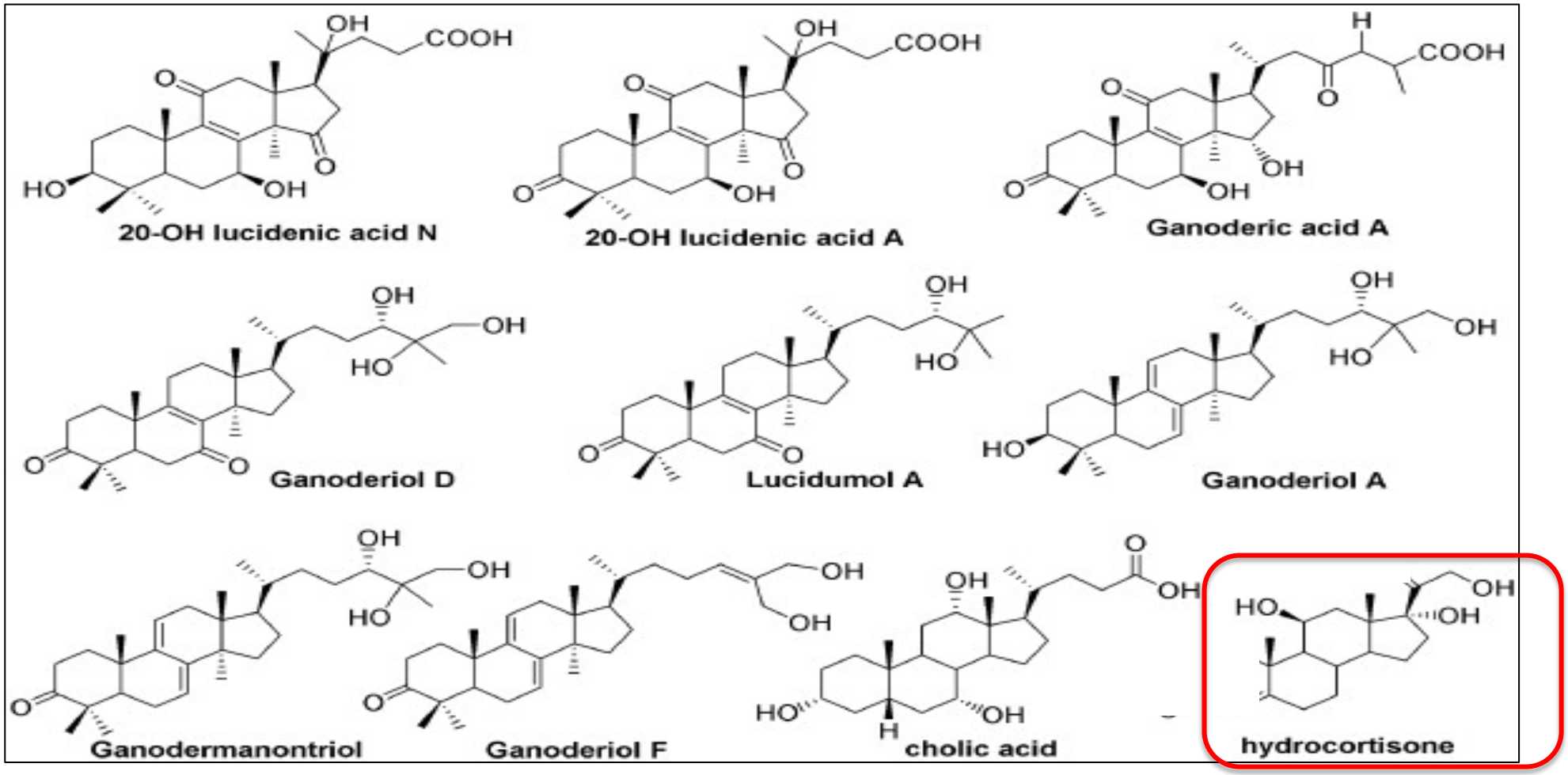
Molecules 2014, 19, 17478-17535; doi:10.3390/molecules191117478

A Comprehensive Review of the Structure Elucidation and Biological Activity of Triterpenoids from Ganoderma spp.

Qing Xia 1,†, Huazheng Zhang 2,†, Xuefei Sun 1, Haijuan Zhao 1, Lingfang Wu 1, Dan Zhu 1, Guanghui Yang 1, Yanyan Shao 1, Xiaoxue Zhang 1, Xin Mao 1, Lanzhen Zhang 1,* and Gaimei She 1,*

Abstract: Ganoderma triterpenes (GTs) are the major secondary metabolites of Ganoderma lucidum, a traditional Chinese medicine, popularly used for complementary cancer therapy. GTs are lanostane-tetracyclic triterpenes. They have been reported to possess anti-tumor, anti-inflammation, antioxidant, antimicrobial and blood fat reducing effects. To date, 316 GTs have been found and their similar chemical structures have proved difficult to elucidate. This paper compiles 316 naturally occurring triterpenes from Ganoderma based on the literature published through January 2013 along with their structures, physiological activities and 13C-NMR spectral data.

Ganoderma Triterpenoid Compounds



Ganoderma Compounds Elucidated

Molecules 2018, 23(3), 649; doi:10.3390/molecules23030649

Review

Antitumour, Antimicrobial, Antioxidant and Antiacetylcholinesterase Effect of Ganoderma Lucidum Terpenoids and Polysaccharides: A Review

Darija Cör 1OrcID, Željko Knez 1,2OrcID and Maša Knez Hrnčič 1,*

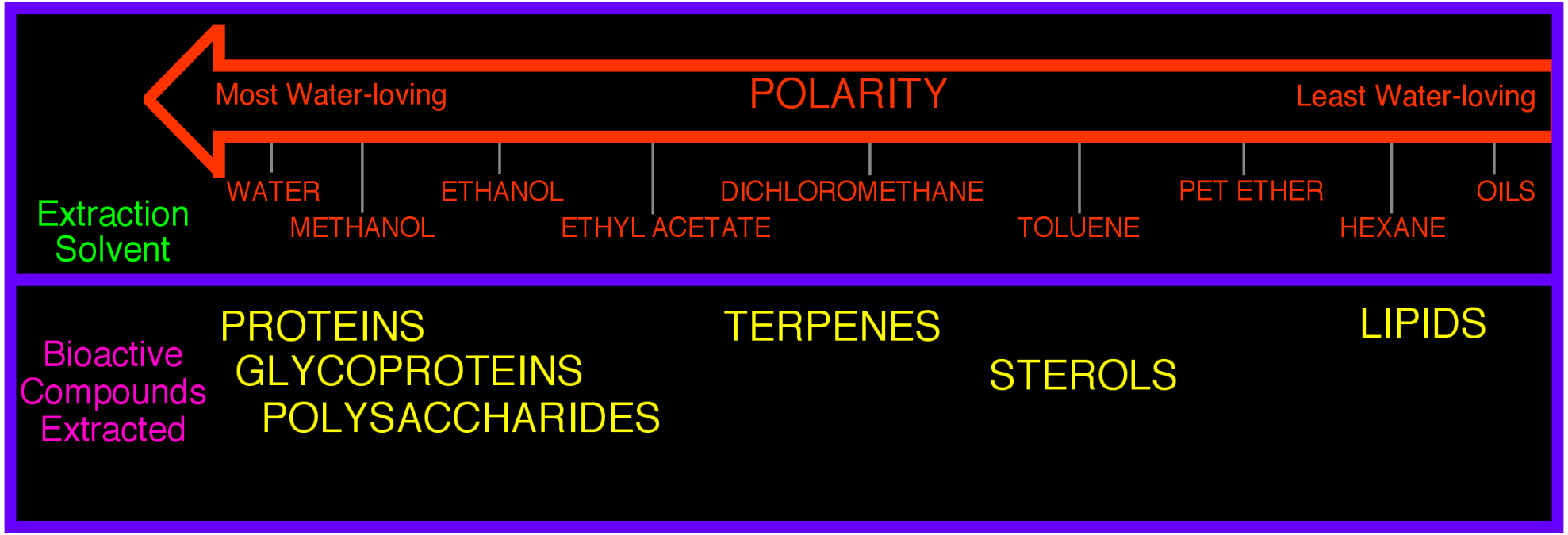
Received: 20 February 2018 / Accepted: 9 March 2018 / Published: 13 March 2018

Abstract: Ganoderma lucidum (Reishi) is a popular medicinal mushroom and has been used in oriental medicine because of its promoting effects on health and life expectancy. G. lucidum contains various compounds with a high grade of biological activty, which increase the immunity and show antitumour, antimicrobial, anti-inflammatory, antioxidant and acetylcholinesterase inhibitory activity. Several of these substances belong to the triterpenoids and polysaccharides classes. Proteins, lipids, phenols, sterols, etc. are also present. In the present review, an extensive overview of the presence of antitumour, antimicrobial, antioxidant and antiacetylcholinesterase compounds in G. lucidum extracts will be given, along with an evaluation of their therapeutic effects.

What do a crab, a cockroach and a mushroom have in common?

Chitin!!

Like extracts Like



Hot Water Soluble:

Polysaccharides
Beta-glucans, Alpha-glucans,
Hetero-glucans,
supporting NK's, Macrophages
And Microbiome
Glycoproteins
Protein-bound polysaccharides, PSP

Alcohol Soluble:

Terpenes, Triterpenoid, Diterpenoid Compounds
Special compounds that may: limit cell release of
inflammatory cytokines, manage cholesterol, balance BP,
modulate histamine effects,
support adaptogenic responses
Sterols & Lipids
Ergosterols – pro-vitamin D
Lanosterol – may serve as a hormone precursor

Polysaccharide Science Experiment Time!

Folk Method (Gina's Granny Method)

- Materials needed: 2-quart mason jars, 1 half gallon mason jar, stockpot, stove, 150-190 proof Etoh (highest proof legal in your state), approximately 3 cups (24 oz) of dried medicinal mushroom pieces of your choice, coffee or other herb grinder (the smaller the pieces, the better), clean and empty tincture dropper bottle, cheesecloth and/or tea strainer, funnel.

Folk Method (Gina's Granny Method)

- Start with dried mushrooms, cut up into smallest size possible. I use a Ninja-pro blender, but a coffee grinder can work as well, just ensure you start with a clean grinder. *Note: If you have wildcrafted your mushrooms, cut them into approximately ½" by ½" pieces when they are still pliable and easy to cut, and then dry them in a food dehydrator. I use an electric knife for larger polypores like Reishi. Make certain the pieces are fully dry to prevent cross-contamination with mold or other microorganisms. Then grind.
- Fill a 1st quart mason jar with 3 cups of the cut and dried mushrooms, then pour EtOH (higher proof is better for terpene extraction) over the marc to just below the top and cap tightly. *Note 1: The smaller the mushroom pieces are the more you can fit, thus the stronger the extract. Leave at least ½ inch to 1 inch space at the top as the pieces will expand slightly when rehydrated with the alcohol.
- Corky mushrooms, such as Reishi, absorb quite a bit of the alcohol initially. Check the next day to ensure the marc is still submerged in the alcohol, you may need to top it off with additional alcohol, recap, and shake vigorously.
- Place in cool, dark location for 2-4 weeks and shake daily.


MORTON
KOSHER SALT

Folk Method (Gina's Granny Method)

- Strain the first extraction through cheesecloth into a separate jar, gently but firmly squeezing the marc to remove as much soaked-in menstruum as possible. You should have around 2 cups of alcohol extraction. Set marc aside in a bowl for the second extraction.
- Measure out 64oz (1/2 gallon) of clean well/spring water or distilled water and pour into a large, heavy bottomed stockpot. Bring water to a boil on the stove.
- When water is boiling, turn heat down to a simmer temperature. Once water appears to be simmering (not a roiling boil) add reserved marc to the water and stir.
- Simmer, uncovered, for approximately 2 hours, stirring occasionally. The goal is to reduce the water by half, leaving approximately 32 oz (1 quart) for the extract. Evaporation happens differently with different climates, altitudes, and stove temps, so keep an eye on the process – you may have to add a bit of water and that is OK!
- After 2 hours, remove from heat and let cool completely before handling. Repeat the straining method you used with the 1st extraction with cheesecloth using your 2nd quart mason jar. (Firmly squeeze so the marc will release any retained water.)
- Thank the marc for its gifts and compost appropriately 😉

Folk Method (Gina's Granny Method)

- Now you should have 1 quart mason jar approximately 1/3 full of alcohol extract, and 1 quart mason jar mostly full of water extract.
- Pour the alcohol extract and water extract into the half gallon mason jar, cap tightly and shake to combine. You now have a double extracted medicinal mushroom extract! The alcohol should equal at least 30%-35% of the final product and will be enough to keep the extract shelf stable for approximately 2 years. *Note: If you want a higher terpene/phenolic content, or if you want shelf stability beyond 2 years, adjust to a 50% EtOH/ 50% water extraction.
- You can now pour into titrated tincture bottles or keep in a batch for addition to future herbal formula preparations. * Note: The polysaccharides may fall out of solution with higher EtOH content, or the longer your mother extraction sits, so always shake well before using in formula or as a simple.

Modern Mushroom Double Extraction

The below apparatus is needed:

- **Magic Butter Machine**
- **Instant Pot (or similar pressure cooker with timer and various settings)**
- **Ninja bullet, Vita mixer, or any high-powered blender**
- **190 proof EtOH**
- **Clean water**
- **Butter muslin**
- **Wide Mouth Half-gallon and quart size mason jars with lids**
- **Wide mouth jar funnel**
- **Large Tea Strainer**
- **Ladle**
- **Large bowl**
- **Scale that measures in grams**

Modern Mushroom Double Extraction

Water Extraction – 1:10 mushroom to menstruum ratio

- **First, prepare the Instant Pot for the water extraction, ensuring that the inside of the apparatus is clean and free of grease or leftover tidbits from other projects.**
- **Measure dried, finely chopped or ground mushroom fruiting body at a 1:10 ratio.**
- **½ gallon of water extraction:**
  - **½ gallon is approximately 2000 ml.**
  - **If using a Ball jar, the ml marks are on the side.**
  - **To come up with a 1:10 ratio, you would find 1/10 of 2000 and this gives you the appropriate grams of dried mushroom.**
    - **1/10 or .10 x 2000 = 200 – so measure out 200 grams of dried mushroom.**

Modern Mushroom Double Extraction

- **Fill the clean half gallon jar up to the 2000 ml mark with clean spring or well water. Try to avoid chlorinated tap water if possible.**
- **Pour the measured water (2000 ml) into the Instant Pot and add the finely ground mushroom marc (200 grams).**
- **Stir gently so that the marc is thoroughly moistened and submerged in the water.**
- **Set Instant Pot to High setting, set the timer to 60 minutes.**
- **Once the timer goes off, manually release with the handle of a spoon, and turn the pot off.**
- **Let the extraction cool completely. (I usually do this process at night, wait until the extract and pot is cool to the touch, then cover it and leave it in the fridge overnight).**

Modern Mushroom Double Extraction

- **Once completely cool, grab a clean, empty half-gallon mason jar, jar funnel, large tea strainer, ladle, large bowl and butter muslin.**
- **Place jar funnel in jar, place tea strainer in funnel, then line with a large square of butter muslin so that it overlaps the funnel.**
  - ******Pro tip: soak the butter muslin in the fluid extract first and squeeze out so that is damp to touch before using.******
- **Carefully, ladle mushroom marc and fluid extract into the draped muslin in batches no bigger than the palm of your hand. There is going to be a whole lot of squeezing going on!**
- **Gather up the overlapping corners of the muslin to form a sack that traps the marc inside, and vigorously squeeze out over the strainer and funnel into the jar.**
- **Once divested of as much liquid as possible, empty squeezed mushroom marc into the bowl and reserve.**
- **Once all marc is done, measure how much liquid extract you have left. You will lose some of the water from the extraction process, so don't be alarmed if you have less than the 2000 mls you started with.**
  - **In this scenario, I had 1125 ml of S.C. extract left after extraction.**
- **Note the final ml of your S.C. water extract, cap and place in fridge while you make the EtOH extract.**

Modern Mushroom Double Extraction

- **Alcohol Extraction: 1:10 mushroom to menstruum ratio, 95% EtOH**
- **Grab the Magic Butter Machine, Everclear or similar 190-proof alcohol, gram scale and bowl.**
- **You must use a minimum of 2 cups of menstruum in the Magic Butter Machine, so we will work backwards to get a 1:10 ratio (Weight to Volume ratio)**
  - **2 cups = 473.2 ml (volume)**
  - **473.2 x .10 or 10% = 47.32 grams (weight)**
- **You will need to measure out 47.32 grams of the reserved mushroom marc from your water extraction for a 1:10 EtOH extraction.**
- **Place 47.32 grams of reserved mushroom marc and 473.2 ml of Everclear into Magic Butter Machine and plug in.**
- **Select 160 degrees and 2 hours for the time.**
- **Watch the pretty lights and think of all the things you are grateful for** 😊

Modern Mushroom Double Extraction

- **When the timer goes off, unplug the machine and take top- off to cool the extraction.**
- **When the EtOH extraction is completely cool, repeat steps 8-12 of the supercritical water extraction and reserve strained extract.**
- **Note the final ml of EtOH extract.**
  - **In this example I had a final yield of 400 ml EtOH extract.**

Modern Mushroom Double Extraction

- **To make a shelf-stable extract, the final solution must be at least 25% EtOH. If using only 2 cups of EtOH to make the extraction, you may end up with more S.C. extraction than needed for the final solution.**
- **Let's Get Mathy!**
- **To get a 25% shelf-stable S.C. hydroethanolic dual extraction, you can use the standard dilution and concentration equation used to make herbal extraction menstruum, with a few tweaks!**
  - **$C_1V_1=C_2V_2$**
- **By using 190 proof Everclear this eliminates the need for complicated math because the extraction will contain 95% pure EtOH.**
- ******the following example was taken from Lisa Ganora's "Making Better Medicine" class. I highly recommend that class and her book – Herbal Constituents – Foundations of Phytochemistry*******

Modern Mushroom Double Extraction

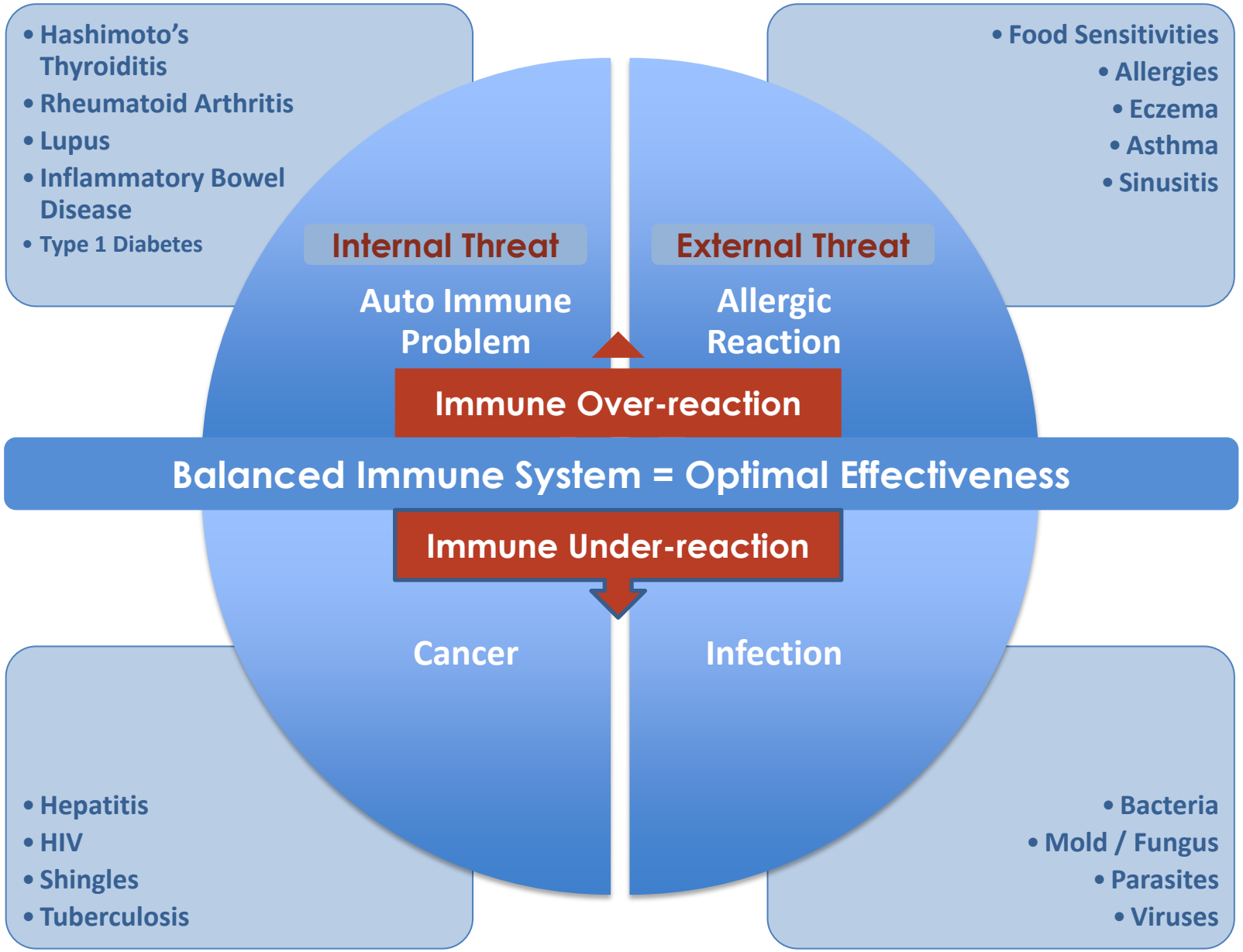
Concentration and Dilution Equation: $C_1V_1=C_2V_2$

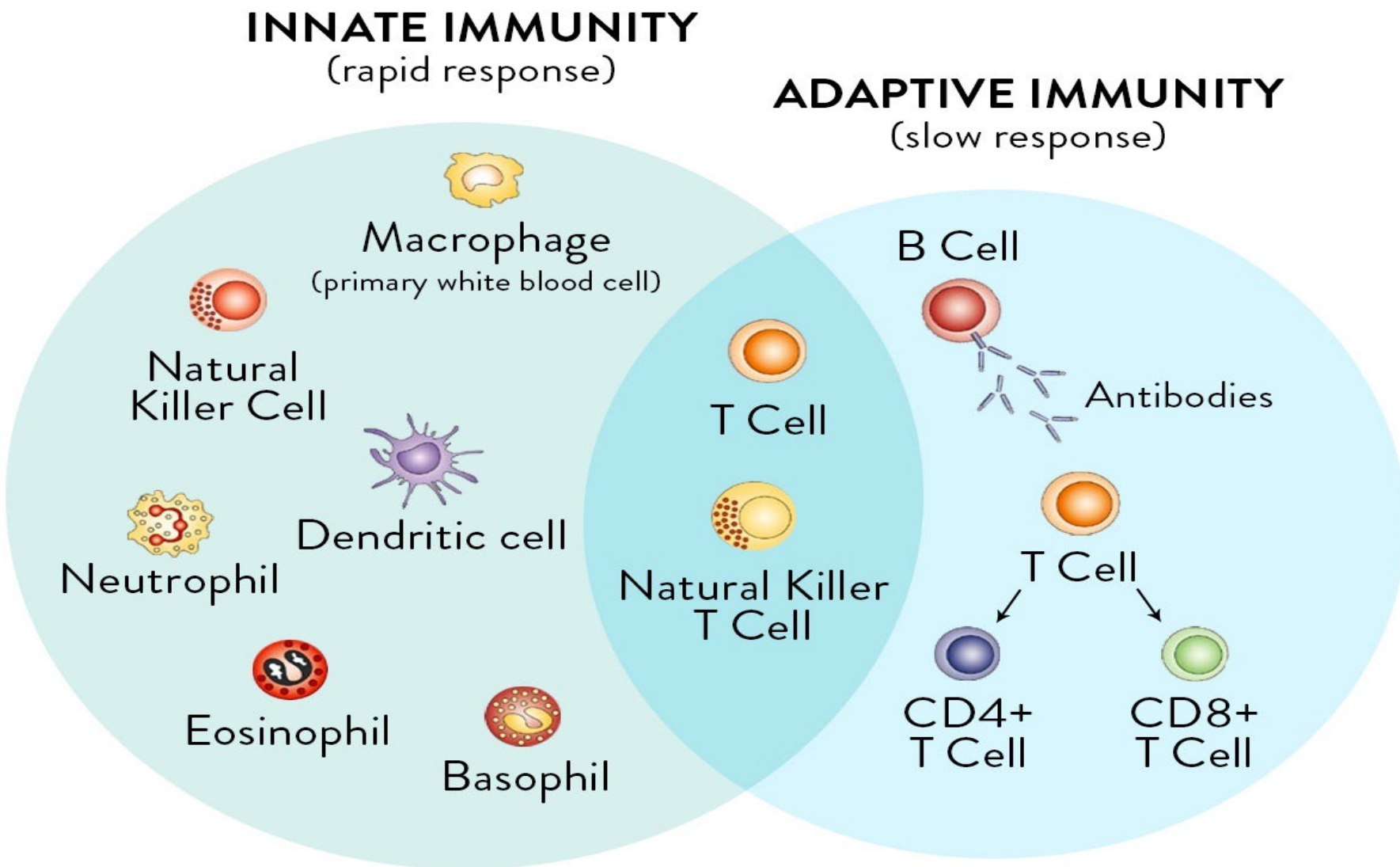
- **Example: You have 400ml of 95% EtOH extraction.**
- **You need your combined solution to equal 25% EtOH of the total volume.**
- **C_1 is 95 (%), V_1 is 400 (ml) [your starting concentration and volume]**
- **C_2 is 25 (%), and V_2 is how much of the S.C. extraction you will need for the final concentration and volume.**
  - **(95)(400) = (25)(? S.C.)**
  - **38,000 = (25)(? S.C.)**
  - **38,000/25 = 1,520**
  - **V_2 (total solution) = 1,520**
  - **1,520 (total solution) – 400 (total EtOH extract) = 1,120 (S.C. extract)**
- **Combine the 400 ml of EtOH extract with 1,120 ml of S.C. extract and Shake It UP BABY!**

Congratulations! You have now made a modern miracle mushroom extract!

Immune System Review

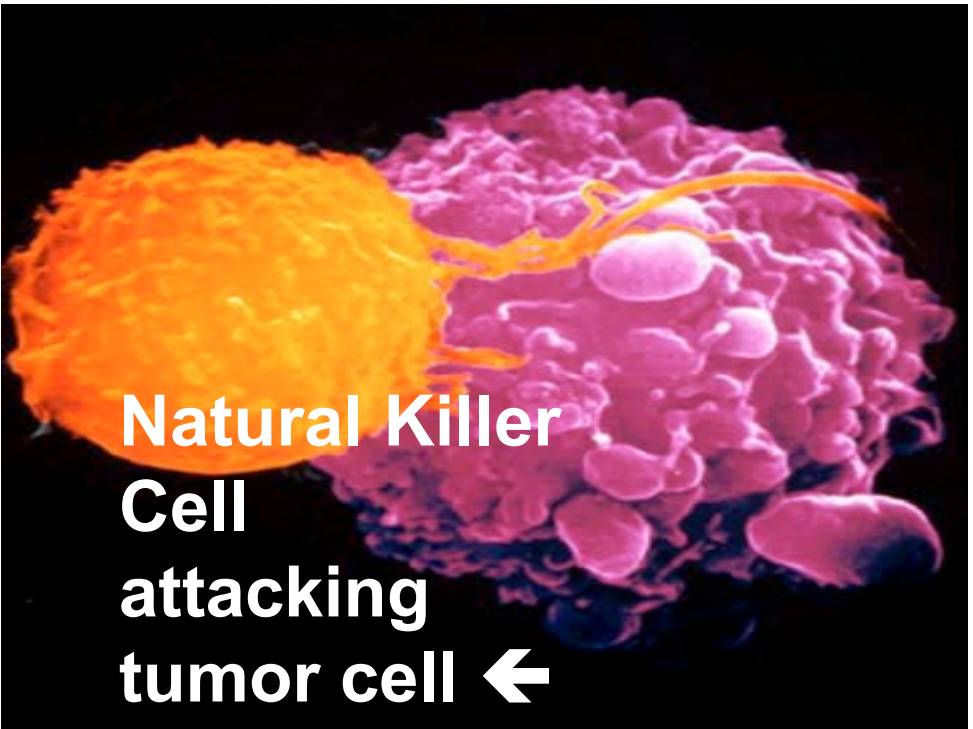
A Balanced Immune System




INNATE IMMUNITY
(rapid response)
ADAPTIVE IMMUNITY
(slow response)
Macrophage
(primary white blood cell)
Natural
Killer Cell
Dendritic cell
Neutrophil
Eosinophil
Basophil
T Cell
Natural Killer
T Cell
B Cell
Antibodies
T Cell
CD4+
T Cell
CD8+
T Cell

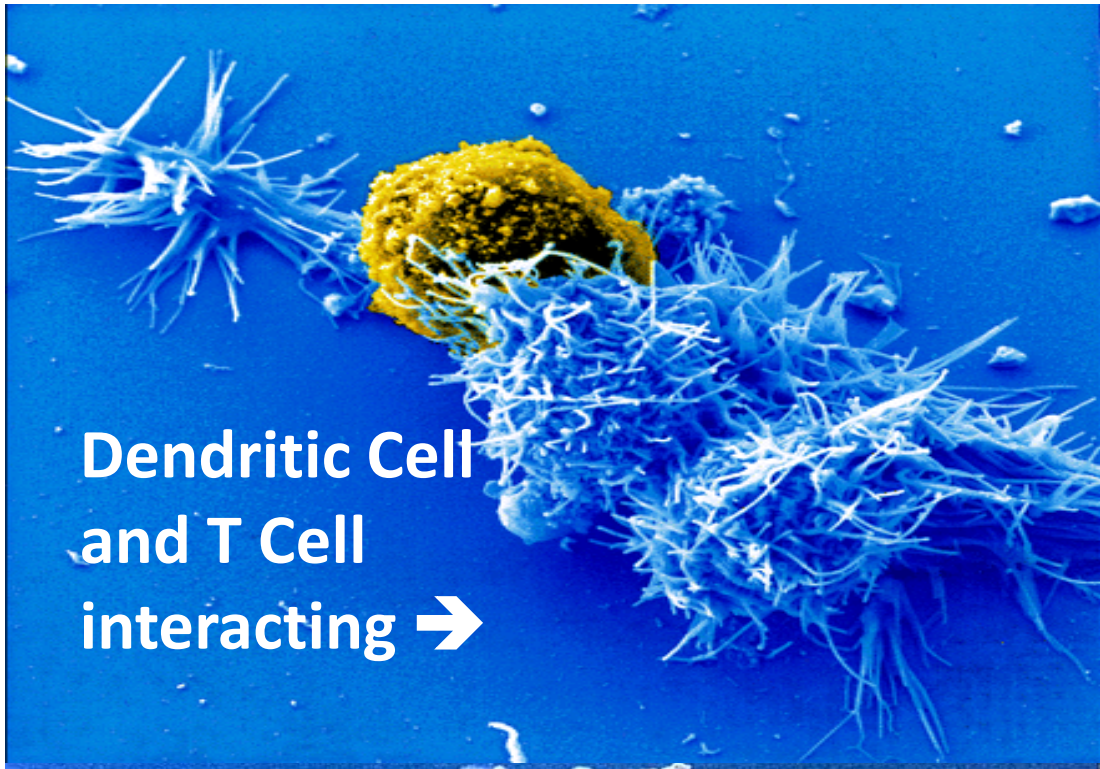
The Innate Immune System

Aka: the Non-specific Immune System contains aspects of Humoral (antibody) and Cell Mediated Immunity (T-cells and cytokines)



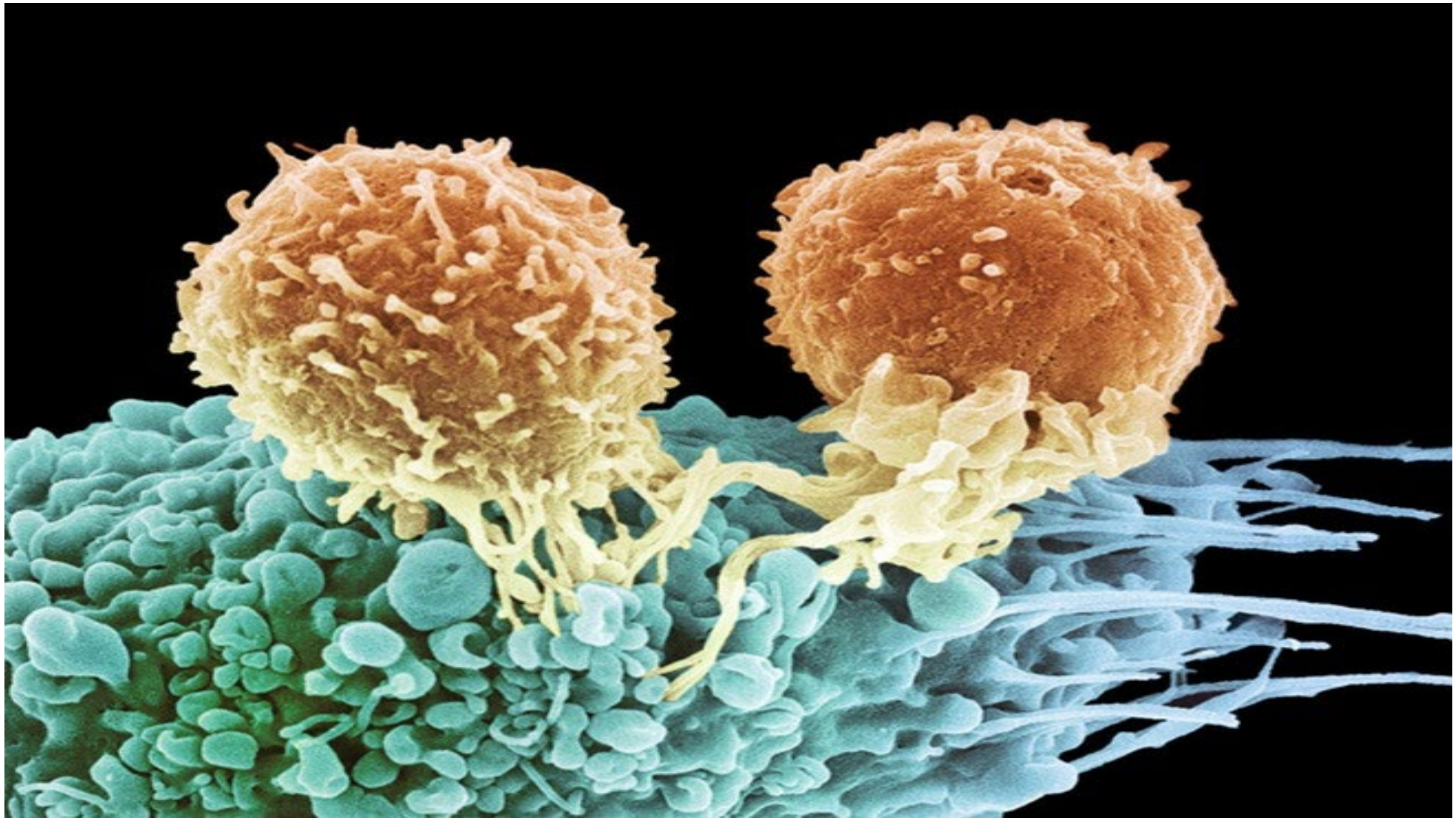
Natural Killer Cell attacking tumor cell ←

Macrophage consuming bacteria →

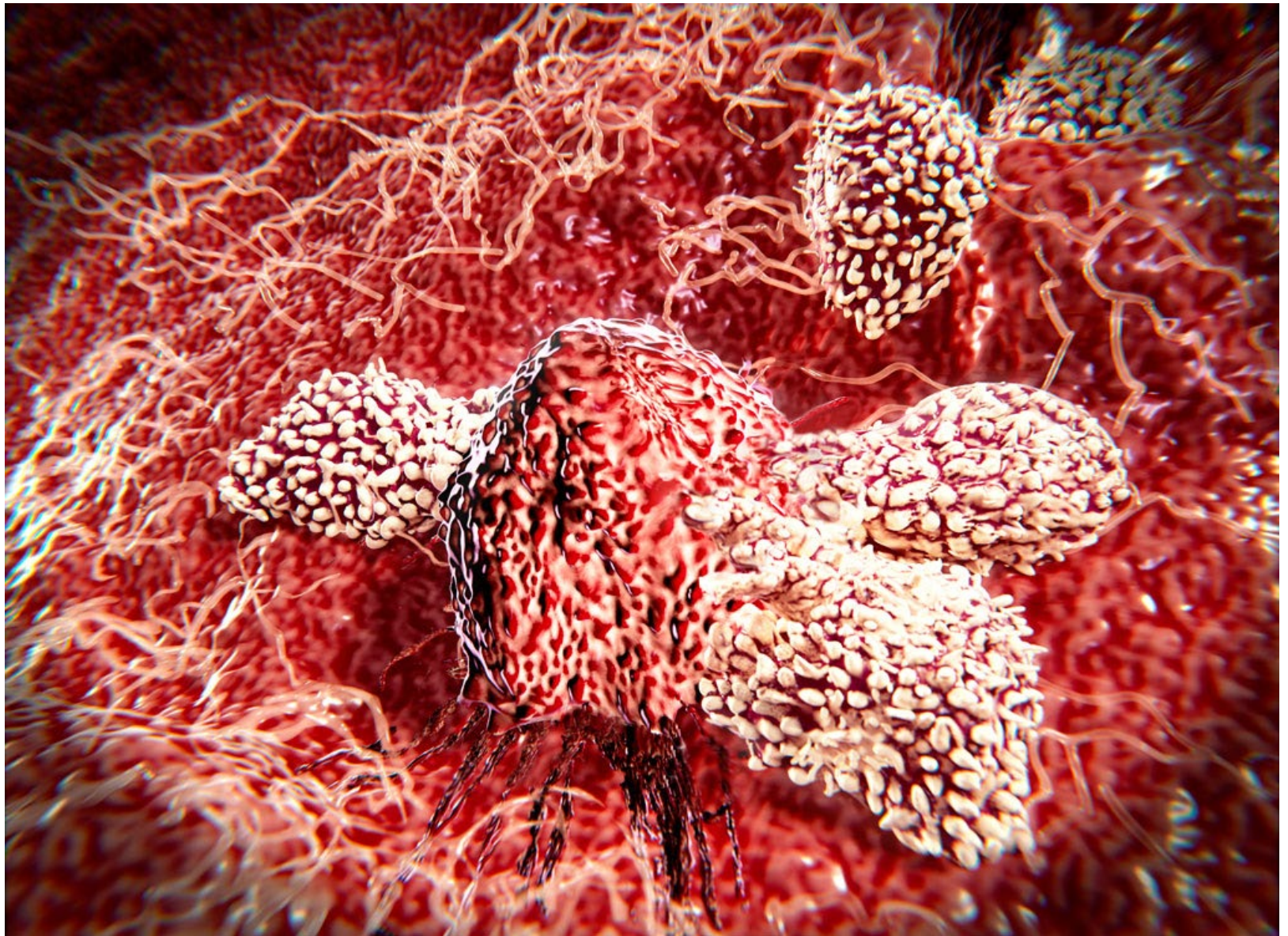


Dendritic Cell and T Cell interacting →

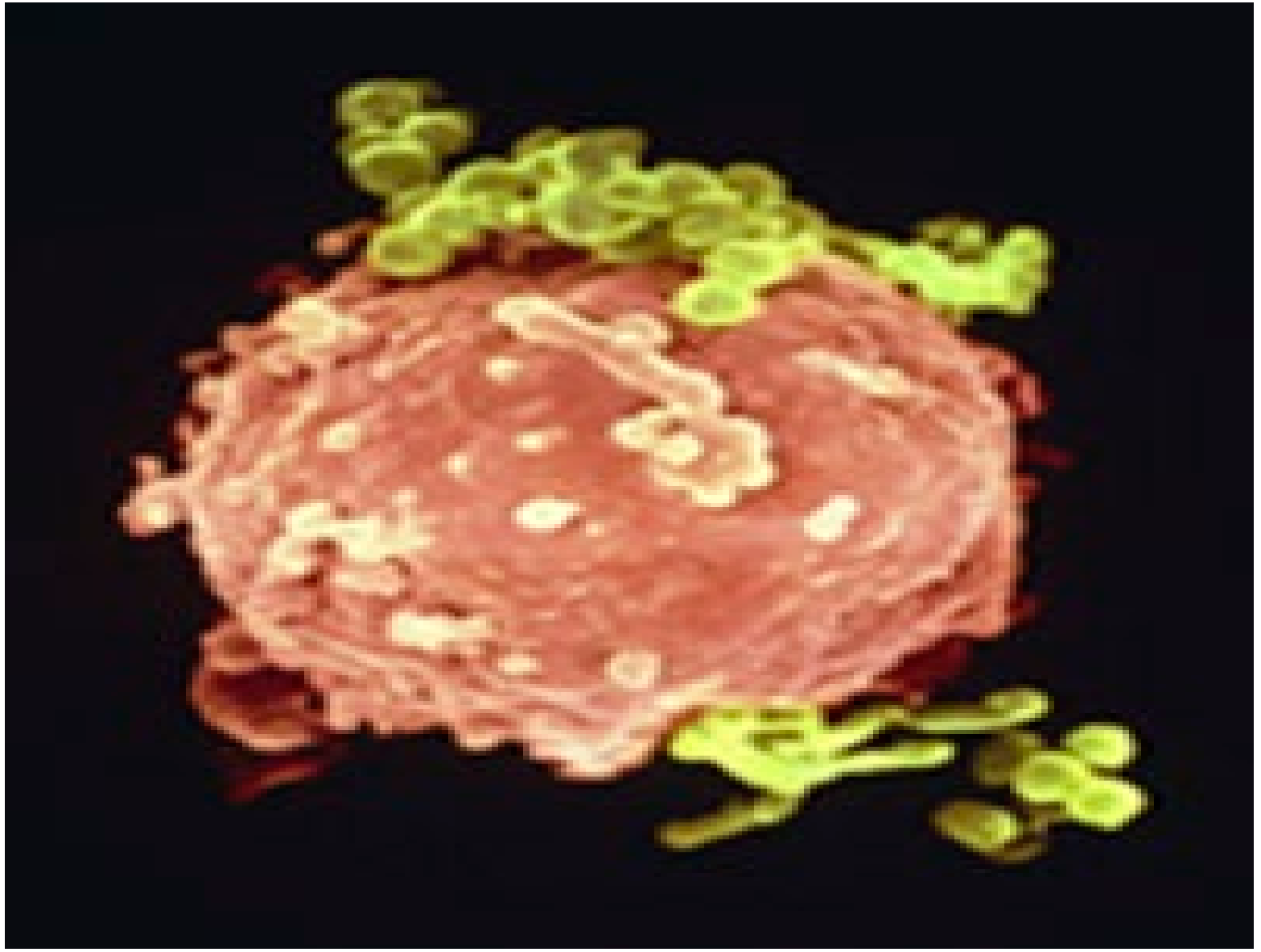
T Lymphocytes Attacking Cancer Cell



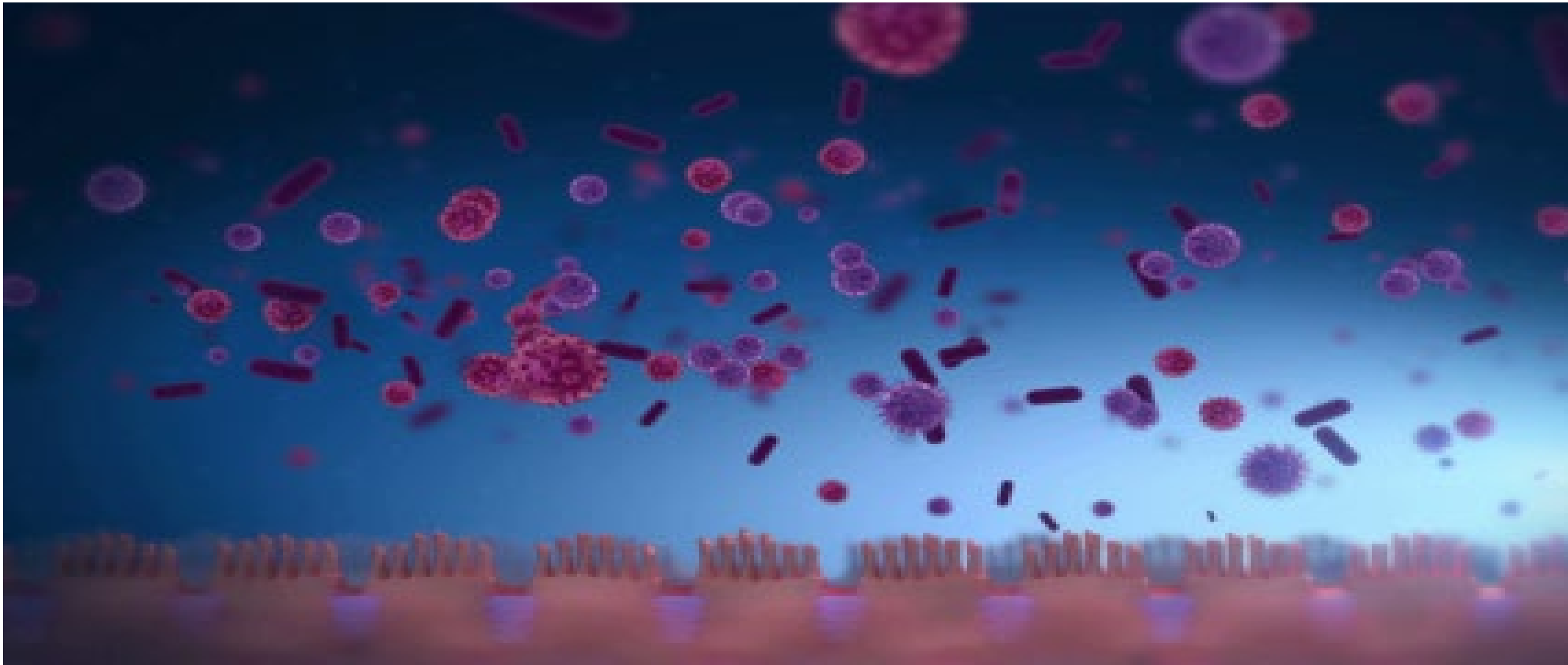
Cytotoxic (CD8+) T Cells Attacking

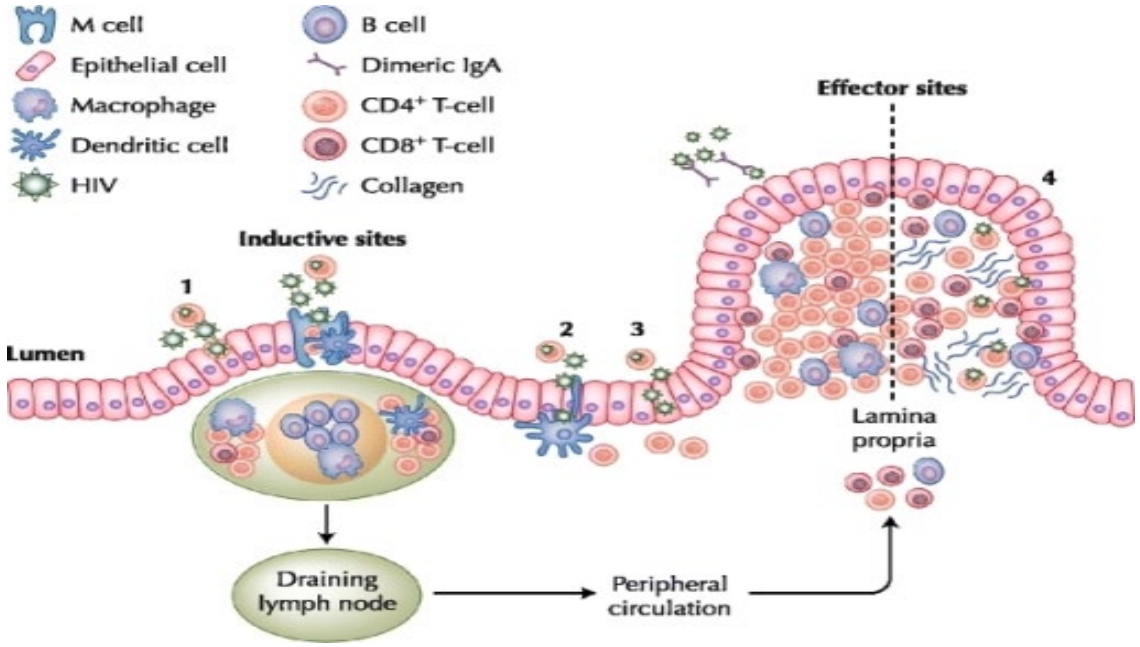


B Cell Receptor Binding of Bacteria



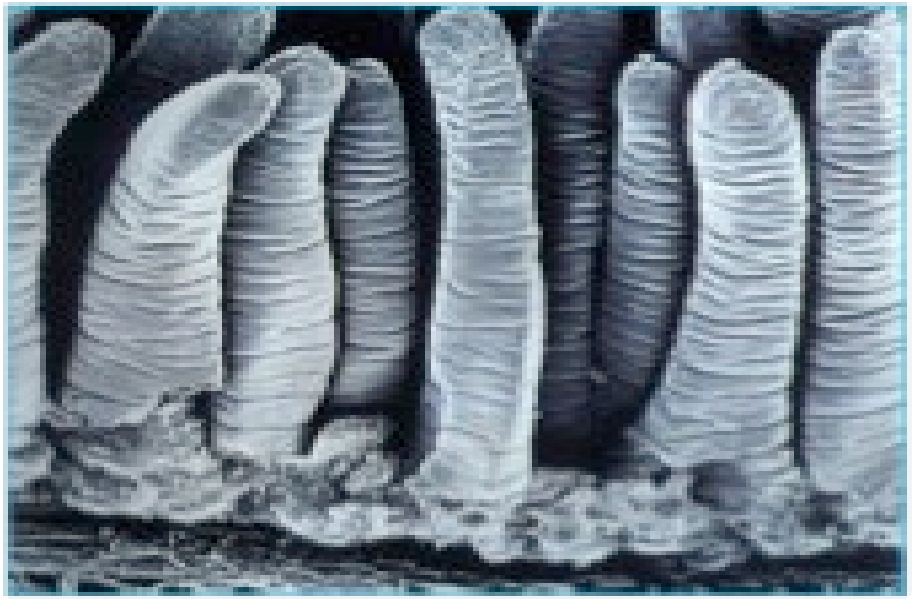
Intestinal tract houses approx 70% of Immune Cells



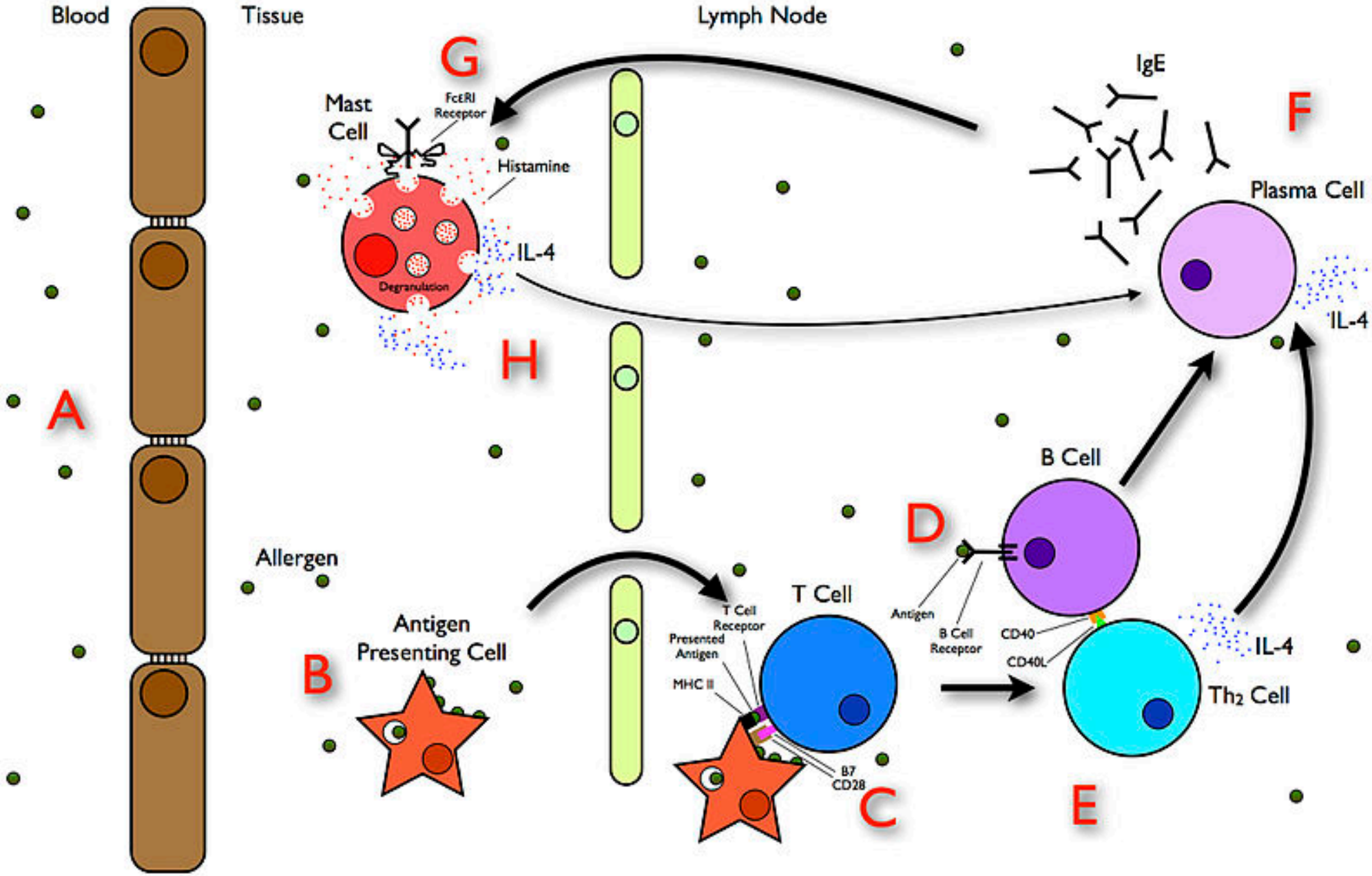


Beta-glucans, Alpha-glucans and Arabinoxylanes are 'tasted' by dendritic cells at brush border and are also absorbed through M-Cells into Peyer's patches.

Attaching to Toll Like receptors on Macrophage and Cytotoxic CD8 cell membrane, polysaccharides and glycoproteins from mushrooms mimic pathogen cell walls. Cell activity up-regulates with expression of cytokine activity.



Normal


Blood
Tissue
Lymph Node
A
B
C
D
E
F
G
H
Mast Cell
FcεRI Receptor
Histamine
IL-4
Degranulation
IgE
Plasma Cell
IL-4
Allergen
Antigen Presenting Cell
T Cell
T Cell Receptor
Presented Antigen
MHC II
B7
CD28
B Cell
Antigen
B Cell Receptor
CD40
CD40L
IL-4
Th2 Cell

Reishi Immune Modulation

Recent Pat Inflamm Allergy Drug Discov. 2014;8(2):104-17.

Suppression of inflammatory and allergic responses by pharmacologically potent fungus Ganoderma lucidum.

Bhardwaj N, Katyal P, Sharma AK1.

Abstract

Acute inflammation is the result of a complex signal transduction pathway that protects and heals our body and is necessary for our good health and normal wellbeing. Whereas, chronic inflammation can be correlated well with the onset of a plethora of autoimmune disorders; rheumatoid arthritis, systemic lupus and polymyalgia, rheumatic and other diseases like asthma, inflammatory bowel diseases, cardiovascular disorders, ulcerative colitis and Crohn's disease. Also, it has been reported to be associated with the onset of various cancers. An effective anti-inflammatory drug should be able to inhibit the development of chronic inflammation without interfering in normal homeostasis. A number of herbal drugs have been identified in the past that can target inflammatory cytokines. Among these, Ganoderma lucidum: a powerful medicinal mushroom has been found to possess immune-modulating and immune-potentiating capabilities and has been characterized as a wonder herb. This review mainly focuses on the molecular mechanism of anti-inflammatory and antiallergic action of this mushroom and also sheds light on various patent studies related to its pharmacological action.

PMID: 24948193

Reishi Immune Modulation

Agents Actions. 1988 Apr;23(3-4):157-60.

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

Tasaka K1, Mio M, Izushi K, Akagi M, Makino T.

Abstract

For centuries, Ganoderma lucidum has been used in Oriental medicine for the treatment of chronic bronchitis. Sequential fractions of the culture medium of this plant revealed that one of the active constituents was cyclooctasulfur.

The latter effectively inhibited histamine release from rat peritoneal mast cells and impeded 45Ca uptake into these cells without affecting the cyclic AMP content.

SDS-PAGE analysis indicated that cyclooctasulfur induced some changes in protein bands obtained from the membrane fraction of mast cells, suggesting that **this compound interacts with membrane proteins so as to inhibit 45Ca uptake, and that this may be the main cause of histamine release inhibition.**

PMID: 2455976

Reishi Immune Modulation

Int Immunopharmacol. 2009 Oct;9(11):1272-80. Epub 2009 Aug 3.

Suppression of the inflammatory response by triterpenes isolated from the mushroom Ganoderma lucidum.

Dudhgaonkar S, Thyagarajan A, Sliva D.

Abstract: Ganoderma lucidum is a popular medicinal mushroom, which has been used in the Traditional Chinese medicine for the prevention or treatment of a variety of diseases. In the present study we evaluated the anti-inflammatory effects of the triterpene extract from G. lucidum (GLT) in LPS-stimulated macrophages. Here we show that GLT markedly suppressed the secretion of inflammatory cytokine tumor necrosis factor-alpha (TNF-alpha) and interleukin-6 (IL-6), and inflammatory mediator nitric oxide (NO) and prostaglandin E(2) (PGE(2)) from lipopolysaccharide (LPS)-stimulated murine RAW264.7 cells. GLT also down-regulated LPS-dependent expression of inducible nitric oxide synthase (iNOS) and cyclooxygenase 2 (COX-2) in RAW264.7 cells. The anti-inflammatory effects of GLT were mediated by the inhibition of transcription factor NF-kappaB as demonstrated by decreased NF-kappaB-DNA binding activity, and the suppression of p65 phosphorylation in LPS-stimulated macrophages treated with GLT. Moreover, GLT inhibited LPS-dependent AP-1-DNA binding activity and down-regulated expression of AP-1 subunit c-Jun. In addition, GLT suppressed the activity of MAP kinases as observed by the down-regulation of LPS-induced phosphorylation of ERK1/2 and JNK but not p38. In vivo experiments clearly demonstrated that GLT also inhibited the production of TNF-alpha and IL-6 in LPS-induced endotoxemic mice. Apart from its anti-inflammatory activity, GLT suppressed cell proliferation of RAW264.7 cells through cell cycle arrest at G0/G1-G2M, which was mediated by the down-regulation of expression of cell cycle regulatory proteins cyclin D1, CDK4 and cyclin B1, respectively. In conclusion, the anti-inflammatory and anti-proliferative effects of GLT on macrophages are mediated through the inhibition of NF-kappaB and AP-1 signaling pathways.

Reishi Immune Modulation

Mol Cell Biochem. 2007 Jul;301(1-2):173-9. Epub 2007 Jan 12.

Ganoderma lucidum polysaccharide peptide reduced the production of proinflammatory cytokines in activated rheumatoid synovial fibroblast.

Ho YW, Yeung JS, Chiu PK, Tang WM, Lin ZB, Man RY, Lau CS.

Abstract: The aim of the current study was to elucidate the potential therapeutic effect of Ganoderma lucidum polysaccharide peptide (GL-PP) in rheumatoid arthritis (RA). The effects of GL-PP on cell proliferation and cytokine production were studied in RA synovial fibroblasts (RASF). GL-PP significantly inhibited the proliferation of RASF. Following the incubation with GL-PP, production of interleukin (IL)-6 and monocyte chemoattractant protein (MCP)-1 in RASF were significantly increased as expressed as percentage change from basal values. However, the actual effects were minimal due to the low basal values. When RASF were activated by IL-1beta or lipopolysaccharides, IL-8 and MCP-1 production increased many folds. GL-PP significantly suppressed their productions. The inhibitory effects of GL-PP on cytokine production in RASF were at least in part, by inhibiting the nuclear factor-kappa B (NF-kappaB) transcription pathway. Our results demonstrated that GL-PP had the unique ability to modulate cytokine production in RASF and warrants further investigation into its mechanism

Reishi and Immune Modulation

Immunol Invest. 2003 Aug;32(3):201-15.

Effects of Ganopoly (a Ganoderma lucidum polysaccharide extract) on the immune functions in advanced-stage cancer patients.

Gao Y1, Zhou S, Jiang W, Huang M, Dai X.

Abstract

Preclinical studies have established that the Ganoderma lucidum polysaccharide (GLPS) fractions have potent anti-tumor activity, which has been associated with the immuno-stimulating effects of GLPS. However, it is unclear whether GLPS has immuno-modulating effects in humans in vivo. This study aimed to investigate the effects of Ganopoly, the polysaccharides fractions extracted from G. lucidum, on the immune function of advanced-stage cancer patients. Thirty-four advance-stage cancer patients were entered onto this study, and treated with 1800 mg Ganopoly, three times daily orally before meals for 12 weeks. Immune parameters (cytokines, T cell subsets, mitotic response to phytohemagglutinin (PHA) and natural killer activity) were compared between baseline and after 12-week treatment. Thirty patients are assessable for their immune functions. Treatment of Ganopoly for 12 weeks resulted in a significant ($P < 0.05$) increase in the mean plasma concentrations of interleukin (IL-2), IL-6, and interferon (IFN)-gamma, whereas the levels of IL-1 and tumor necrosis factor (TNF-alpha) were significantly ($P < 0.05$) decreased. A marked variability among patients with advanced-stage cancer was observed in the numbers of each lymphocyte subset at baseline. The mean absolute number of CD56+ cells was significantly ($P < 0.05$) increased after 12-week treatment of Ganopoly, whereas the numbers of CD3+, CD4+, and CD8+ were just marginally increased compared to baseline levels, with the CD4:CD8 T cell ratios unchanged. PHA responses after 12-week treatment with Ganopoly were enhanced in most patients, when compared to pretreatment baselines ($P < 0.05$). In addition, Ganopoly treatment resulted in a significant increase ($P < 0.05$) in the mean NK activity compared to baselines (34.5 +/- 11.8% vs 26.6 +/- 8.3%). The present study indicates that Ganopoly enhanced the immune responses in patients with advanced-stage cancer. Clinical evaluations of response and toxicity are ongoing.

PMID: 12916709

The Primary Immune System The Microbiome

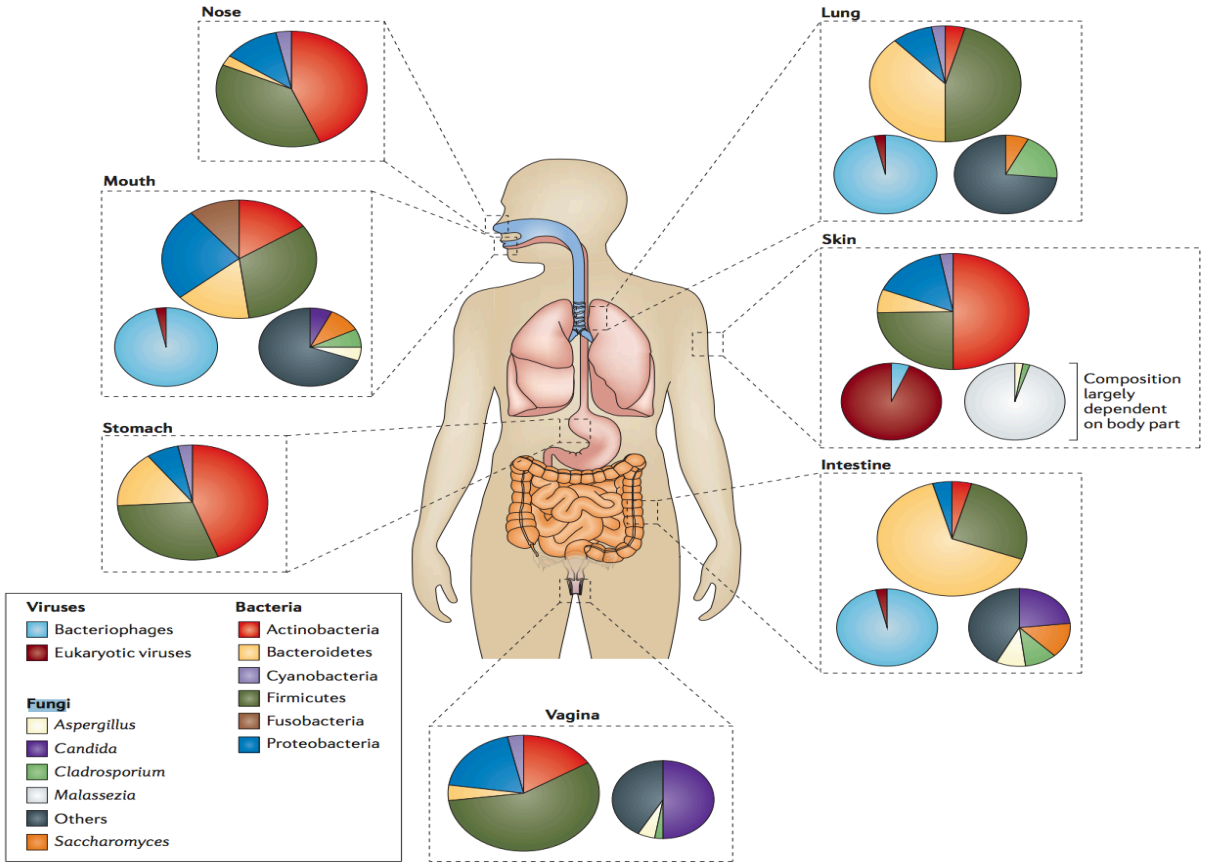


Figure 1 | **The composition of the bacterial, fungal and viral microbiota at distinct body sites.** The figure shows the relative abundance of bacterial, fungal and viral communities at different body sites exposed to the external environment — the nose, mouth, skin, stomach, intestinal tract, vagina and lungs. Bacterial composition is represented by the six most commonly detected phyla — Actinobacteria, Bacteroidetes, Cyanobacteria, Firmicutes, Fusobacteria and Proteobacteria. Fungal composition includes *Aspergillus*, *Candida*, *Cladrosporium*, *Malassezia* and *Saccharomyces* as the most prominent genera. Additional types of fungi are summarized as 'Others'. Viral composition is classified simply as bacteriophages or eukaryotic viruses. Data based on REFS 1,22,88,89.

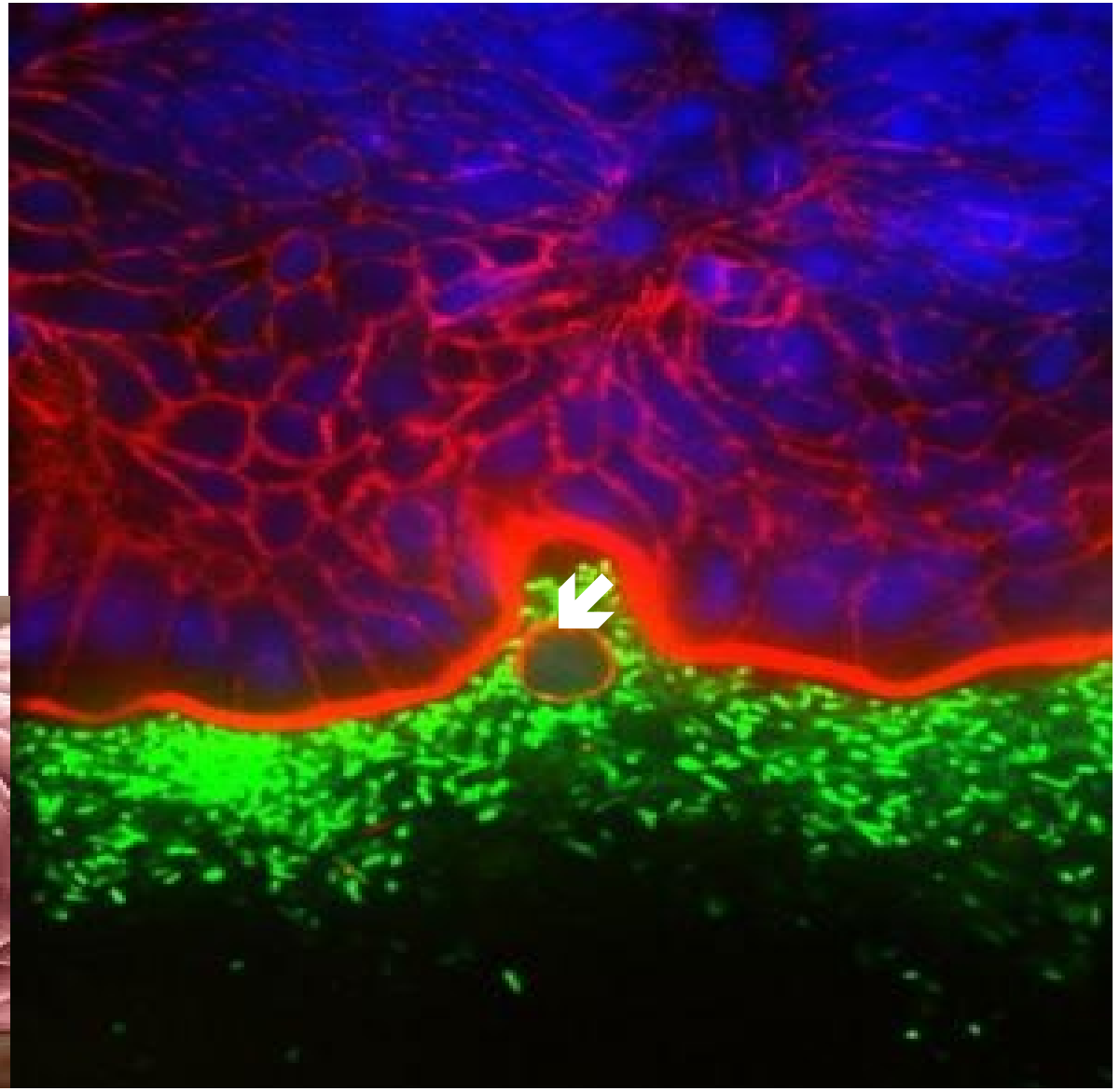
Our Individualized ecosystems are comprised of probiotic and pathogenic micro-organisms

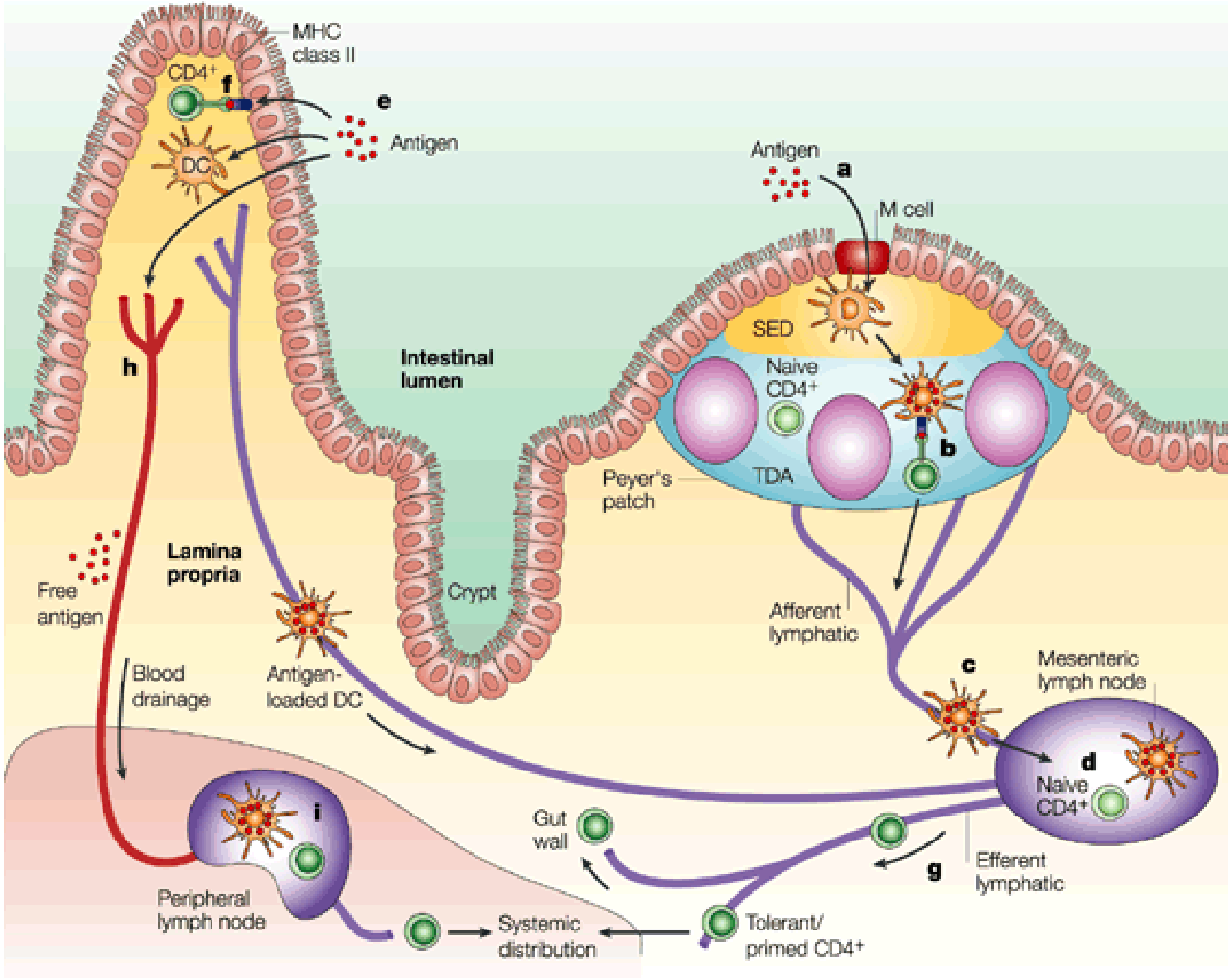
The composition of the bacterial, fungal and viral microbiota at distinct body sites. The figure shows the relative abundance of bacterial, fungal and viral communities at different body sites exposed to the external environment — the nose, mouth, skin, stomach, intestinal tract, vagina and lungs.

Data based on REFS 1,22,88,89.

PERSPECTIVES p. 828 | DECEMBER 2014 | VOLUME 14 Host–microorganism interactions in lung diseases. Benjamin J. Marsland and Eva S. Gollwitzer

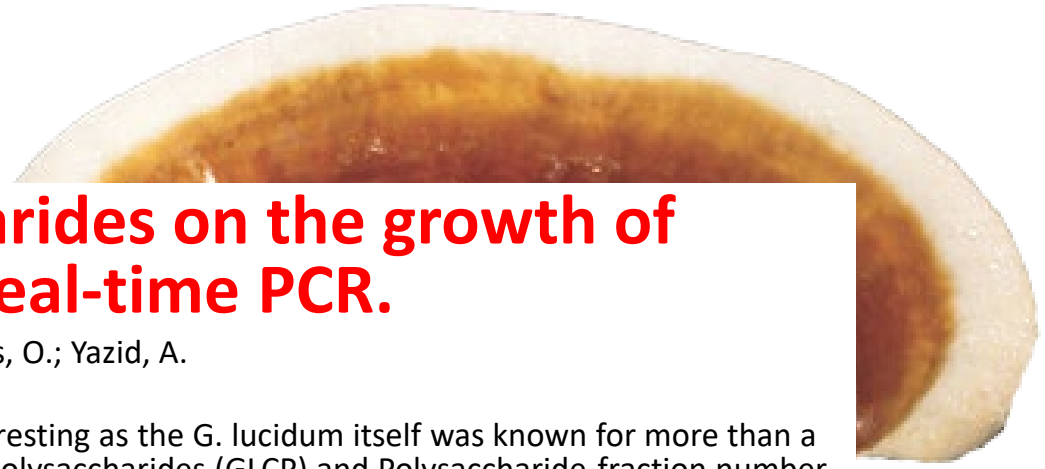
The barriers of brush border and its mucous lining house an army of beneficial bacteria which are immediate in their response as well as intelligent in their ability to perform specialized functions.





Nature Reviews | Immunology

Reishi



Effect of *Ganoderma lucidum* polysaccharides on the growth of Bifidobacterium spp. as assessed using real-time PCR.

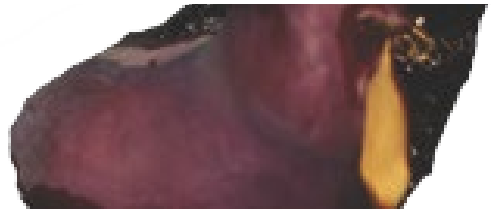
Author(s) : Yamin, S.; Shuhaimi, M.; Arbakariya, A.; Fatimah, A. B.; Khalilah, A. K.; Anas, O.; Yazid, A.

International Food Research Journal 2012 Vol.19 No.3 pp.1199-1205 ref.29

Abstract : The use of component from Ganoderma lucidum as prebiotic source is interesting as the G. lucidum itself was known for more than a decade in the traditional Chinese medicine. In this work, Ganoderma lucidum crude polysaccharides (GLCP) and Polysaccharide-fraction number 2 (PF-2) were used as carbon sources in the fermentation with Bifidobacterium sp. The results showed the potential of prebiotic effect of the G. lucidum extract in batch-culture fermentation based on increment in the growth of bacteria used (0.4-1.5 log10 CFU/mL) after 18h fermentation. Fermentation was further done using faecal materials as bacterial inocula and bacterial growth changes were examined using real-time PCR.

The results showed the ability of GLCP and PF-2 to support the growth of Bifidobacterium genus with 0.3 and 0.7 log10 cells/ml increased, respectively. Interestingly, Lactobacillus which is known as beneficial bacterial genus also showed growth increment with 0.7 and 1 log10 cells/ml increased. The competition for carbon sources thus inhibits the growth of potentially harmful genus, Salmonella (0.3 and 0.5 log10 cells/ml) in comparison to the control.

Our results indicate that G. lucidum and its high molecular weight polysaccharides may be used as prebiotic agents to prevent gut dysbiosis and obesity-related metabolic disorders in obese individuals.



Beyond Immunity – Reishi's Systemic Applications


Reishi: The Imperial Tonic

Imperial Tonic: Blood Sugar

Medicines (Basel). 2018 Jul 28;5(3). pii: E78. doi: 10.3390/medicines5030078.

Hypoglicemic and Hypolipedimic Effects of Ganoderma lucidum in Streptozotocin-Induced Diabetic Rats.

Bach EE1, Hi EMB2, Martins AMC3, Nascimento PAM4, Wadt NSY5.

Abstract

Background:Ganoderma lucidum (Leyss. Ex. Fr) Karst is a basidiomycete mushroom that has been used for many years as a food supplement and medicine. In Brazil, National Health Surveillance Agency (ANVISA) classified Ganoderma lucidum as a nutraceutical product. The objective of the present work was to observe the effects of an extract from Ganoderma lucidum in rats treated with streptozotocin, and an agent that induces diabetes. Method: Male Wistar rats were obtained from the animal lodging facilities of both University Nove de Julho (UNINOVE) and Lusiada Universitary Center (UNILUS) with approval from the Ethics Committee for Animal Research. Animals were separated into groups: (1) C: Normoglycemic control water; (2) CE: Normoglycemic control group that received hydroethanolic extract (GWA); (3) DM1 + GWA: Diabetic group that received extract GWA; and (4) DM1: Diabetic group that received water. The treatment was evaluated over a 30-day period. Food and water were weighted, and blood plasma biochemical analysis performed. Results: G. lucidum extract contained beta-glucan, proteins and phenols. Biochemical analysis indicated a decrease of plasma glycemic and lipid levels in DM rats induced with streptozotocin and treated with GWA extract. Histopathological analysis from pancreas of GWA-treated DM animals showed preservation of up to 50% of pancreatic islet total area when compared to the DM control group. In plasma, Kyn was present in diabetic rats, while in treated diabetic rats more Trp was detected. Conclusion: Evaluation from G. lucidum extract in STZ-hyperglycemic rats indicated that the extract possesses hypoglycemic and hypolipidemic activities. Support: Proj. CNPq 474681/201.

PMID: 30060545 DOI: 10.3390/medicines5030078

Imperial Tonic: Cardiovascular Impact

Zhongguo Zhong Xi Yi Jie He Za Zhi. 2002 Jul;22(7):534-7.

[Effect of lugu *Ganoderma lucidum* on low-density lipoprotein oxidation and monocyte adhesion to endothelium].

Zhang HM, Yao WJ, Tian HK.

Abstract OBJECTIVE: To study the effect of Lugu Ganoderma Lucidum (LGL) on low-density lipoprotein (LDL) oxidation and monocyte adhesion to endothelium (AdM-E) induced by oxydative LDL and advanced glycosylation endproducts (AGE) by using serum pharmacological technique.
METHODS: LDL oxidation was determined by measuring the thiobarbituric acid reactive substances in the supernatants, and AdM-E was determined by measuring myeloperoxidase activity of adherent monocyte.
RESULTS: Serum derived from rats 0.5 hrs, 1 hr, 2 hrs, 3 hrs after LGL administering 0.12 g/kg once and 0.5 hrs, 1 hr after LGL administering twice showed no significant effect on LDL oxidation, but the serum from rats 2 hrs, 3 hrs after LGL 0.12 g/kg administering twice or from rats after 10 successive days LGL administering in dose of 0.12 g/kg, 0.24 g/kg and 0.72 g/kg, all could lower the LDL oxidation ($P < 0.05$). Besides, the serum from rats with 10 days LGL administering of all dosages also could inhibit AdM-E induced by AGE ($P < 0.05$), and those of 0.24 g/kg and 0.72 g/kg could inhibit AdM-E induced by oxydative LDL ($P < 0.05$).
CONCLUSION: **LGL could decrease LDL oxidation and AdM-E induced by AGE or oxydative LDL.**

Imperial Tonic: Intestinal Health

Volume 74, Issue 5, November 2011, Pages 454–462

Inflamm Bowel Dis. 2015 Aug;21(8):1918-25. doi: 10.1097/MIB.0000000000000439.

Anti-inflammatory Effects of Ganoderma lucidum Triterpenoid in Human Crohn's Disease Associated with Downregulation of NF-κB Signaling.

Liu C1, Dunkin D, Lai J, Song Y, Ceballos C, Benkov K, Li XM.

Abstract

BACKGROUND: Crohn's disease (CD) is a chronic inflammatory disease of the gastrointestinal tract. Current medications have potentially serious side effects. Hence, there is increasing interest in alternative therapies. We previously demonstrated the anti-inflammatory effects of Food Allergy Herbal Formula-2 in vitro on peripheral blood mononuclear cells (PBMCs) and mucosa from CD subjects. Here, we investigated the anti-inflammatory effects of a bioactive compound isolated from Ganoderma lucidum (G. lucidum), a key herbal constituent of Food Allergy Herbal Formula-2, in CD in vitro.

METHODS: Triterpene ganoderic acid C1 (GAC1) was isolated from G. lucidum. Stimulated RAW 264.7 macrophages were treated with GAC1. Human PBMCs and colonic biopsies were obtained from children with CD and cultured with or without GAC1. TNF-α and other proinflammatory cytokine levels were measured in the culture supernatant. NF-κB signaling was investigated in PBMCs and colonic mucosa treated with GAC1 by In-Cell Western and Western blot analysis.

RESULTS: GAC1 decreased TNF-α production by macrophages and PBMCs from CD subjects. GAC1 significantly decreased TNF-α, IFN-γ, and IL-17A production by inflamed colonic biopsies from CD subjects. These effects were due to downregulation of the NF-κB signaling pathway.

CONCLUSIONS: GAC1 inhibited production of TNF-α and other proinflammatory cytokines by PBMCs and inflamed CD colonic mucosa due to blockage of NF-κB activation. GAC1 is a key beneficial constituent in G. lucidum and the Food Allergy Herbal Formula-2 in suppressing the inflammatory cytokines found in CD and warrants clinical investigation for the treatment of CD.

Imperial Tonic: Liver Support

Pharm Biol. 2017 Dec;55(1):1041-1046. doi: 10.1080/13880209.2017.1288750.

Triterpenoids and polysaccharide peptides-enriched Ganoderma lucidum: a randomized, double-blind placebo-controlled crossover study of its antioxidation and hepatoprotective efficacy in healthy volunteers.

Chiu HF1, Fu HY2, Lu YY3, Han YC2, Shen YC4, Venkatakrishnan K2, Golovinskaia O5, Wang CK2.

Abstract

OBJECTIVE: The current study examines whether triterpenoids and polysaccharide-enriched G. lucidum (GL) influence antioxidation and hepatoprotective efficacy by suppressing oxidative stress.

MATERIALS AND METHODS: Forty-two healthy subjects (22 male and 20 female) were recruited and segregated into two groups as experimental or placebo and requested to intake GL (n = 21) or placebo (n = 21) capsule (225 mg; after lunch or dinner) for six consecutive months and vice versa with one month washout period in between. The anthropometric analysis and biochemical assays, as well as abdominal ultrasonic examination were performed.

RESULTS: Consumption of GL substantially improved ($p < 0.05$) the total antioxidant capacity (TEAC; 79.33-84.04), total thiols and glutathione content (6-8.05) in plasma as well as significant ($p < 0.05$) enhanced the activities of antioxidant enzymes. Whereas, the levels of thiobarbituric acid reactive substances (TBARS; 3.37-2.47), 8-hydroxy-deoxy-guanosine (8-OH-dG; 15.99-11.98) and hepatic marker enzymes (glutamic-oxaloacetic transaminase; GOT and glutamic-pyruvic transaminase; GPT) were concomitantly reduced (42 and 27%) on treatment with GL. Furthermore, the abdominal ultrasonic examination in GL subjects displayed a notable alteration on hepatic condition by reversing from mild fatty liver condition (initial) to normal condition.

DISCUSSION AND CONCLUSION: The outcome of the present intervention demonstrated the antioxidation, anti-aging and hepatoprotective nature of GL by effectively curbing oxidative stress.

PMID: 28183232 DOI: 10.1080/13880209.2017.1288750

Imperial Tonic: Kidney Support

Kidney Int. 2017 Jul 11. pii: S0085-2538(17)30301-0.

Ganoderma triterpenes retard renal cyst development by downregulating Ras/MAPK signaling and promoting cell differentiation.

Su L, Liu L, Jia Y, Lei L, Liu J, Zhu S, Zhou H, Chen R, Lu HAJ, Yang B.

Abstract

Autosomal dominant polycystic kidney disease (ADPKD) is a common monogenetic disease characterized by the progressive development of renal cysts with further need for effective therapy. Here our aim was to investigate the effect of Ganoderma triterpenes (GT) on the development of kidney cysts. Importantly, GT attenuated cyst development in two mouse models of ADPKD with phenotypes of severe cystic kidney disease. Assays for tubulogenesis showed that GT promoted epithelial tubule formation in MDCK cells, suggesting a possible effect on epithelial cell differentiation. The role of GT in regulating key signaling pathways involved in the pathogenesis of PKD was further investigated by immune blotting. This showed that GT specifically downregulated the activation of the Ras/MAPK signaling pathway both in vitro and in vivo without detectable effect on the mTOR pathway. This mechanism may be involved in GT downregulating intracellular cAMP levels. Screening of 15 monomers purified from GT for their effects on cyst development indicated that CBLZ-7 (ethyl ganoderate C2) had a potent inhibitory effect on cyst development in vitro. Additionally, like GT, CBLZ-7 was able to downregulate forskolin-induced activation of the Ras/MAPK pathway. Thus, GT and its purified monomer CBLZ-7 may be potential therapeutic regents for treating ADPKD.

Imperial Tonic: Endurance

Nutr Hosp. 2015 Nov 1;32(5):2126-35.

Ganoderma lucidum improves physical fitness in women with fibromyalgia.

Collado Mateo D, Pazzi F, Domínguez Muñoz FJ, Martín Martínez JP, Olivares PR, Gusi N, Adsuar JC.

Abstract in English, Spanish

INTRODUCTION: fibromyalgia is a chronic disease characterized by generalized pain, stiffness, poor physical conditioning, non-restorative sleep and poor health-related quality of life. Ganoderma lucidum a type of mushroom that has demonstrated several benefits in different populations. Ceratonia siliqua is a natural therapy rich in antioxidants with potential benefits on health.

OBJECTIVE: to evaluate the effects of 6-week treatment of Ganoderma lucidum and Ceratonia siliqua on physical fitness in patients suffering from fibromyalgia.

METHODS: sixty-four women with fibromyalgia participated in the study. They took 6 g of Ganoderma lucidum or Ceratonia siliqua per day for 6 weeks. Different fitness tests were selected in order to evaluate functional capacity.

RESULTS: after the 6-week treatment period, Ganoderma lucidum significantly improved aerobic endurance, lower body flexibility, and velocity ($p < .05$). No significant improvement in any physical test was observed in the Ceratonia siliqua group.

DISCUSSION AND CONCLUSION: *Ganoderma lucidum* may improve physical fitness in women with fibromyalgia, whereas, Ceratonia siliqua seemed to be ineffective at increasing physical fitness. These results may indicate that *Ganoderma lucidum* might be a useful dietary supplement to enhance physical performance of the patients suffering from fibromyalgia.

Imperial Tonic: Sleep

Pharmacol Biochem Behav. 2007 Apr;86(4):693-8. Epub 2007 Feb 22.

Extract of Ganoderma lucidum potentiates pentobarbital-induced sleep via a GABAergic mechanism.

Chu QP1, Wang LE, Cui XY, Fu HZ, Lin ZB, Lin SQ, Zhang YH.

Abstract

Ganoderma lucidum has been used for the treatment of a variety of diseases. For the first time here we report a detailed study on the mechanisms and effects of G. lucidum aqueous extract (GLE) on sleep and its sedative activity. GLE showed no effects on sleep architecture in normal rats at doses of 80 and 120 mg/kg. However, GLE significantly decreased sleep latency, increased sleeping time, non-REM sleep time and light sleep time in pentobarbital-treated rats. Suppression of locomotor activity in normal mice induced by GLE was also observed. Flumazenil, a benzodiazepine receptor antagonist, at a dose of 3.5 mg/kg showed a significant antagonistic effect on the shortening in sleep latency, increase in sleeping time, non-REM sleep time or light sleep time in pentobarbital-treated rat induced by GLE. Significant effect was also observed with GLE on delta activity during non-REM sleep and flumazenil did not block this effect. In conclusion, GLE may be a herb having benzodiazepine-like hypnotic activity at least in part.

PMID: 17383716 DOI: 10.1016/j.pbb.2007.02.015

Imperial Tonic: Sympathetic Nervous System

Chemical and Pharmaceutical Bulletin: Vol. 38 (1990) No. 5 P 1359-1364

Cardiovascular Effects of Mycelium Extract of *Ganoderma lucidum* : Inhibition of Sympathetic Outflow as a Mechanism of Its Hypotensive Action

Seung Y. LEE, Hee M. RHEE

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

Ganoderma lucidum
Neurological Impact

Evid Based Complement Alternat Med. 2015;2015:865986. doi: 10.1155/2015/865986. Epub 2015 Apr 6

Chronic Treatment wi
Medium of *Ganoderm*
Necroptosis in Hypox

the ischemic penumbra, whi
cleaved caspase-3-positive
interacting protein kinase 3 r
suggest that MAK confers re
induced cerebral ischemic in

PMID: 25945116

Prev Nutr Food Sci. 2015 Jun;20(2):126-32. doi: 10.3746/pnf.2015.20.2.126. Epub 2015 Jun 30.

Anti-Amnesic Effect of Fermented *Ganoderma lucidum* Water Extracts by Lactic Acid Bacteria on Scopolamine-Induced Memory Impairment in Rats.

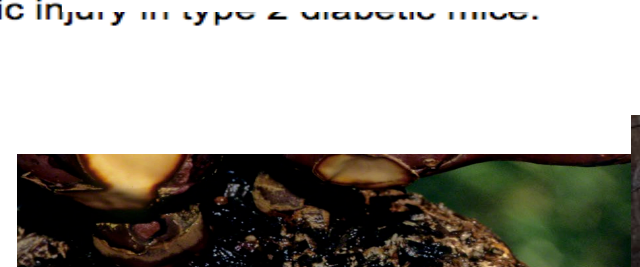
Choi YJ1, Yang HS1, Jo JH1, Lee SC1, Park TY2, Choi BS2, Seo KS2, Huh CK1.

Abstract

This study investigated the anti-amnesic effect of fermented *Ganoderma lucidum* water extracts (GW) on scopolamine-induced memory impairment in rats. GW were fermented by the lactic acid bacterium *Bifidobacterium bifidum* (FGWB), followed by *Lactobacillus sakei* LI033 (FGWBL). To induce amnesia, scopolamine (1 mg/kg) was intraperitoneally injected into rats 30 min before the behavioral tests. Step-through latencies of rats treated with primary fermented extracts (300 mg/kg, FGWB) and secondary fermented extracts (300 mg/kg, FGWBL) were significantly longer than those of rats treated with GW (300 mg/kg) in the retention trial of the multiple trial passive avoidance test. In the Morris water maze task, FGWBL significantly shortened escape latencies in training trials. Furthermore, swimming times within the target zone during the probe trial with FGWBL were significantly higher than the GW and FGWB treatments. In addition, acetylcholinesterase activities were lower in the brains of scopolamine-treated rats treated with FGWBL. These results suggest that FGWBL could be useful to enhance learning memory and cognitive function via cholinergic dysfunction.

KEYWORDS:
Ganoderma lucidum; Morris water maze test; fermentation; passive avoidance test; scopolamine

PMID: 26176000



Imperial Tonic: DNA Protection

Food Chemistry: Volume 119, Issue 3, 1 April 2010, Pages 1040–1043

Enhancement of repair of radiation induced DNA strand breaks in human cells by *Ganoderma* mushroom polysaccharides

Thulasi G. Pillai, , C.K.K. Nair, K.K. Janardhanan

Abstract: The DNA repair ability of a cell is vital to the integrity of its genome and thus to its normal functioning and that of the organism. The repair-enhancing property of polysaccharides isolated from *Ganoderma lucidum* which belongs to the polyporaceae family was determined by comet assay in human peripheral blood leukocytes. Comet parameters were studied at 2 Gy gamma irradiation with 15 min intervals. The comet parameters after 2 Gy exposures to γ-radiation were reduced to nearly normal levels after 120 min of exposure. **The polysaccharides from *G. lucidum* enhance the repair process, which is a promising approach for protection from radiation exposure, but a detailed study of the molecular mechanism is needed for further application.**

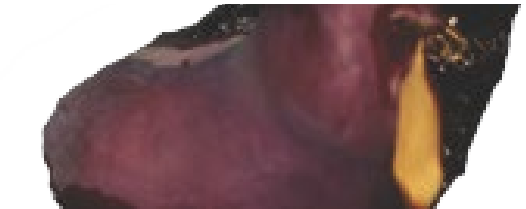
Reishi and Resistance Reversal

Int J Oncol. 2015 May;46(5):2029-38. doi: 10.3892/ijo.2015.2925. Epub 2015 Mar 12.

Ganoderma lucidum derived ganoderenic acid B reverses ABCB1-mediated multidrug resistance in HepG2/ADM cells.

Liu DL, Li YJ, Yang DH, Wang CR, Xu J, Yao N, Zhang XQ, Chen ZS, Ye WC, Zhang DM.

Abstract: Chemotherapy is one of the most common therapeutic option for metastatic tumors and hematological malignancies. ABCB1-mediated multidrug resistance is the major obstacle for chemotherapy. Natural products with diversified structures are ideal source of ABCB1 modulators. Ganoderenic acid B, a lanostane-type triterpene isolated from Ganoderma lucidum, exhibited potent reversal effect on ABCB1-mediated multidrug resistance of HepG2/ADM cells to doxorubicin, vincristine and paclitaxel. Similarly, ganoderenic acid B could also significantly reverse the resistance of ABCB1-overexpressing MCF-7/ADR cells to doxorubicin. Furthermore, ganoderenic acid B notably enhanced intracellular accumulation of rhodamine-123 in HepG2/ADM cells through inhibition of its efflux. ABCB1 siRNA interference assay indicated that the reversal activity of ganoderenic acid B was dependent on ABCB1. Further mechanistic investigations found that ganoderenic acid B did not alter the expression level of ABCB1 and the activity of ABCB1 ATPase. Molecular docking model displayed that the positions of ganoderenic acid B binding to ABCB1 were different from the region of verapamil interacted with ABCB1. Collectively, ganoderenic acid B can enhance the cytotoxicity of chemotherapeutics towards ABCB1-mediated MDR cancer cells via inhibition of the transport function of ABCB1. **These findings provide evidence that ganoderenic acid B has the potential to be developed into an ABCB1-mediated multidrug resistance reversal agent**.



Reishi and Contraindications

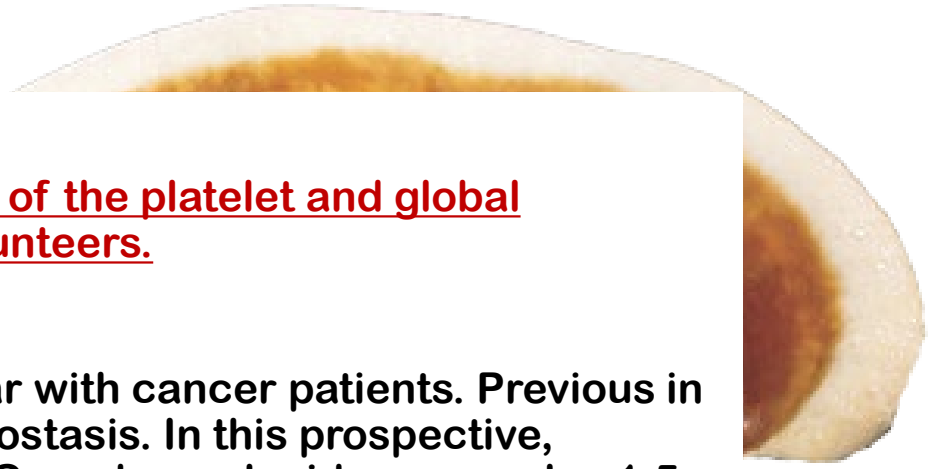
Mycologia: Vol. 92, No. 3 (May - Jun., 2000), pp. 545-552

Fibrinolytic and Antithrombotic Protease from Ganoderma lucidum

Hye-Seon Choi and Yu-Seon Sa

Abstract: A putative metalloprotease was purified from mycelium of Ganoderma lucidum. The enzyme was purified by anion exchange, chromatofocusing, and gel filtration chromatography. The Mr was determined to be 52,000 by SDS-PAGE and 100,000 by gel filtration on a Sephadex G-150 column, indicating that it is a dimer. The enzyme was inhibited by EDTA, 1,10-phenanthroline, and phosphoamidon. The presence of Zn2+ was detected by ICP mass spectral analysis an 1.1 mol of Zn2+ per mol of protease. This protease hydrolyzed Aalpha and Bbeta chains of human fibrinogen, but did not cleave thrombin, albumin, hemoglobin, and immunoglobulin under the same condition. It also showed an anticoagulant activity in human plasma. The enzyme delayed the activated partial thromboplastin time and thrombin time, but not the clotting induced by reptilase, indicating Ganoderma protease behaved as a competitive inhibitor of thrombin-catalyzed fibrin formation, but no inhibition of thrombin was found with a snall synthetic peptide. These observations indicate that Ganoderma protease could bind thrombin at an anion binding exosite distinct from the active site and cause the delay of clotting time induced by thrombin.

Reishi and Contraindications



Anesth Analg. 2005 Aug;101(2):423-6, table of contents.

A prospective, randomized, double-blind, placebo-controlled study of the platelet and global hemostatic effects of Ganoderma lucidum (Ling-Zhi) in healthy volunteers.

Kwok Y1, Ng KF, Li CC, Lam CC, Man RY.

Abstract: Ganoderma lucidum is a Chinese herbal medicine popular with cancer patients. Previous in vitro studies suggested that Ganoderma lucidum might impair hemostasis. In this prospective, randomized double-blind study, healthy volunteers received orally Ganoderma lucidum capsules 1.5 g (n = 20) or placebo (n = 20) daily for 4 wk. We monitored subjects before drug administration and at 4 and 8 wk thereafter by routine coagulation screen, fibrinogen concentration, von Willebrand ristocetin cofactor activity, platelet function analyzer PFA-100, and thrombelastography. There were no significant between-group differences and all measureents remained within the normal range. Ganoderma lucidum ingestion over 4 wk was not associated with impairment of hemostasis.

IMPLICATIONS:

Ingestion of Ganoderma lucidum does not cause impairment of hemostatic function in healthy volunteers, despite earlier in vitro reports that it may cause platelet inhibition and may have other antithrombotic and fibrinolytic activity. The use of Ganoderma lucidum preoperatively is unlikely to increase the risk of surgical bleeding in otherwise healthy patients.

Mushrooms and Herbs Complement Each Other

Acta Biol Hung. 2009 Sep;60(3):281-91. doi: 10.1556/ABiol.60.2009.3.5.

Study on genes with altered expression in alpha-amanitin poisoned mice and evaluation on antagonistic effects of traditional Chinese medicines against toxicity of alpha-amanitin.

Chen Q1, Cao M, Xiang WL, Sun Q, Zhang J, Hou RT, Yan ZY, Yang ZR, Liu J, Zhao J.

Abstract: The forward and reverse cDNA subtractive libraries before and after the toxic effect of alpha-amanitin were constructed by suppression subtractive hybridization and randomly selected clones from each subtractive library were screened by PCR and dot blot hybridization. A total of 85 genes with altered expression were finally identified, with 41 genes from the forward library and 44 from the reverse library. Subsequently, the antagonistic effects of candidate traditional Chinese medicines were evaluated based on the genetic transcription levels of the genes with significant altered expression, including Catnbeta, Flt3-L, IL-7r and Rpo2-4. The results indicated that Silybum marianum (L.) Gaert and Ganoderma lucidum had significant down-regulated effects on the transcription level of Catnbeta that was up-regulated by alpha-amanitin, and the two herbs also up-regulated the transcription levels of Flt3-L and Rpo2-4. Silybum marianum (L.) had significant up-regulated effects on the IL-7r that was down-regulated by alpha-amanitin.

Conclusion: These preliminary studies suggested that *Silybum marianum* (L.) and *Ganoderma lucidum* were effective antagonists against the toxicity of alpha-amanitin.

Let's Build an Herbal Formula with Reishi!

Clinical Scenario #1

Client is 54 yo overweight male with primary complaint of fatigue.
Hx of hyperlipidemia, hypertension, and mild fatty liver disease. Adverse reaction to statin drugs, not currently taking pharmaceuticals except occasional OTC NSAIDs.
Family Hx Father deceased of myocardial infarction at 62 yo; mother deceased At 76 yo breast cancer; no siblings

Herbal Allies?

REISHI Research suggests:
Balances Blood Fats
Protects heart muscle in hypoxia
Antioxidative to cardiomyocytes
Keeps LDL from oxidizing
Hepatoprotective
Adaptogenic/ Antifatigue/ Promotes Endurance

Clinical Scenario #2

Client is 38 yo female with primary complaint of being “stressed out” Hx of prediabetes (A1C results 5.8 and 6.2 in last 6 mo.) Currently in Litigation for divorce and custody battle. Trouble loosing weight and Reports trouble sleeping. No pharmaceuticals, no family Hx of diabetes. Both parents and 2 siblings still living.

Herbal Allies?

REISHI Research suggests:
Insulin and blood sugar regulation
Decreases sympathetic outflow
“fight or flight”
Adaptogenic/ Antifatigue/ Promotes Endurance
Decreases sleep latency and promotes restful sleep

Clinical Scenario #3

Client is 23 year old female who's primary complaint is poor immune health. She has been diagnosed from allergist with Multiple Chemical Sensitivity plus allergic to wheat, corn and dairy. Pharmaceuticals are Asthma inhaler prn, and just came off an 8 week course of amoxicillin Prescribed for recent respiratory infection.
Hx of eczema and frequent infections.

Herbal Allies?

REISHI Research suggests:
Upregulation of NK Cells and Macrophages
Downregulation of histamine release
Downregulation of inflammatory Cytokines
Prebiotic for Bifidobacterium and L. Acidophilus

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Thank You!!!!!

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