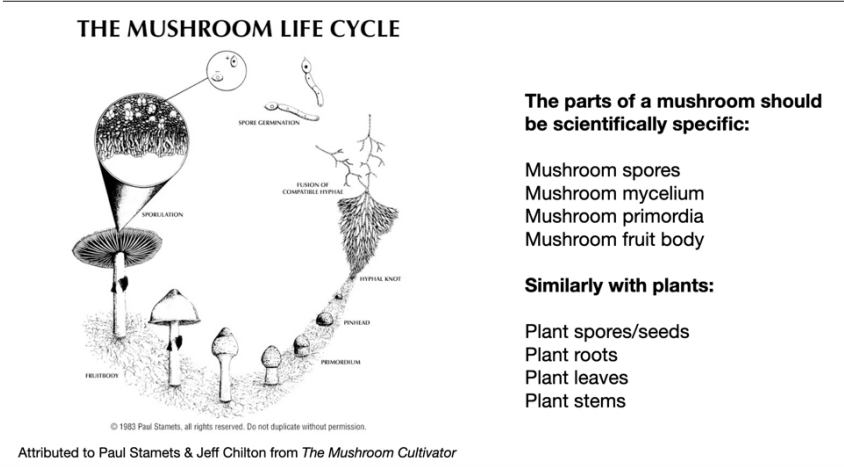


June 20th, 2023  
Olympia, WA

### AN OPEN LETTER FROM DIVERSE-STAKEHOLDER MUSHROOM COMPANIES ON NAMMEX CITIZEN PETITION TO FDA

Although Fungi Perfecti, LLC, M2 Ingredients Inc., Gourmet Mushrooms, Inc., and Monterey Mushrooms Inc. are competitors, we are unified to emphasize the importance of conveying scientifically accurate information to the public, to FDA, and to other thought leaders in the field. From this standpoint we are responding to the puzzling opinion presented in the recent [FDA Citizen Petition](#) submitted by Nammex, and find that their position obfuscates the use of well-established mycological definitions.

In this Citizen Petition, Nammex advocates to eliminate the use of the word ‘mushroom’ in products using mushroom mycelium. Our collective use of ‘mushroom mycelium’ is scientifically accurate, just as the use of ‘mushroom spores’, ‘mushroom fruit bodies’ are descriptively accurate. The word “mushroom” describes the organism itself, whereas terms like “mycelium” and “fruit body” refer to distinct parts of the mushroom organism. This is perfectly parallel to saying ‘plant roots’, ‘plant seeds/spores’, and ‘plant flowers’. Both sets of terminologies describe the parts of the organism. To propose the elimination of the word “mushroom” (again, the name of the organism), results in confusion; for example, “mycelium” on its own would not distinguish mold mycelium from mushroom mycelium. Below The Mushroom Life Cycle diagram, as it appears in The Mushroom Cultivator by Paul Stamets & Jeff Chilton, depicts clearly-named stages of the mushroom life cycle.



When mycologists dissect a mushroom fruit body and examine a sample under the microscope, they typically describe the tissue in terms of the types of hyphae that compose the mushroom fruit body. What are hyphae? *Hyphae are filaments of mycelium.* Mushroom fruit bodies are made of compacted mushroom mycelium. The recent article *Hyphal systems and their effect on the mechanical properties of fungal sporocarps* describes how hyphae (filaments of mushroom mycelium) construct a sporocarp (mushroom fruit body). A mushroom fruit body is comprised of mushroom mycelium physically organized in a distinct structure as compared to the mushroom mycelium network-like stage. The word ‘mushroom’ can both be a noun and used as a qualifier as to the stage of the life cycle.

### **The Mushroom Life Cycle: when the fruit body/sporocarp is, in fact, made of hyphae.**

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#### **Hyphal systems and their effect on the mechanical properties of fungal sporocarps**

Debora Lyn Porter, Steven E Naleway

##### **Abstract**

Little is known about the mechanical and material properties of hyphae, the single constituent material of Agaricomycetes fungi, despite a growing interest in fungus-based materials. In the Agaricomycetes (the mushrooms and allies), there are three types of hyphae that make up sporocarps: generative, skeletal, and ligative. All filamentous Agaricomycetes can be categorized into one of three categories of hyphal systems that compose them: monomitic, dimitic, and trimitic. Monomitic systems have only generative hyphae. Dimitic systems have generative and either skeletal (most common) or ligative. Trimitic systems are composed of all three kinds of hyphae. SEM imaging, compression testing, and theoretical modeling were used to characterize the material and mechanical properties of representative monomitic, dimitic, and trimitic sporocarps. Compression testing revealed an increase in the compression modulus and compressive strength with the addition of more hyphal types (monomitic to dimitic and dimitic to trimitic). The mesostructure of the trimitic sporocarp was tested and modeled, suggesting that the difference in properties between the solid material and the microtubule mesostructure is a result of differences in structure and not material. Theoretical modeling was completed to estimate the mechanical properties of the individual types of hyphae and showed that skeletal hyphae make the largest contribution to mechanical properties of fungal sporocarps. Understanding the contributions of the different types of hyphae may help in the design and application of fungi-based or bioinspired materials. **STATEMENT OF SIGNIFICANCE:** This research studies the material and mechanical properties of fungal sporocarps and their hyphae, the single constituent material of Agaricomycetes fungi. Though some work has been done on fungal hyphae, this research studies hyphae in context of the three hyphal systems found in Agaricomycetes fungi and estimates the properties of the hyphal filaments, which has not been done previously. This characterization was performed by analyzing the structures and mechanical properties of fungal sporocarps and calculating the theoretical mechanical properties of their hyphae. This data and the resulting conclusions may lead to a better design and implementation process of fungi-based materials in various applications using the properties now known or calculated.



**When dissecting and examining a piece of a mushroom fruit body under a microscope, mycologists describe the type of cells making up the flesh in terms of the type of hyphae. *Hyphae are filaments of mycelium.***

<https://bioinspired.mech.utah.edu/wp-content/uploads/sites/25/2022/05/43-Porter-D.-L.-Acta-Bio.-2022.pdf>

In its Citizen’s Petition, Nammex also advocates for label disclosure of the “fungal part/growth stage” of mushroom ingredients. Here, we agree.

American Herbal Products Association (AHPA) produces “guidance documents on labeling to help the industry comply with applicable laws and regulations, and to institute best practices that help ensure quality and transparency.”

For mushroom dietary supplements, their labeling guidelines state that:

*'Ingredients other than dietary ingredients in such products are disclosed in the product label's ingredient list preceded by the words "Other ingredients," as described in 21 CFR 101.4(g) ....if any are still remaining in the fungal ingredient; other non-dietary ingredients used in the manufacture of the dietary supplement product, i.e., excipients such as fillers, binders, flow agents, etc.; and non-dietary ingredients that are ingredients within ingredients and are present in non-trivial amounts, such as excipients that are added to an extract (e.g., maltodextrin or the marc from the extraction starting material (e.g., "shiitake fruitbody marc")).'*

See:

[https://www.ahpa.org/Files/Document%20Library/AHPAGuidancePolicies/AHPA\\_Guidance\\_on\\_fungi\\_labeling.pdf](https://www.ahpa.org/Files/Document%20Library/AHPAGuidancePolicies/AHPA_Guidance_on_fungi_labeling.pdf)

AHPA guidelines emphasize that extracts sprayed back onto the marc must be disclosed. To this day, consumers purchasing products made from mushroom fruit body extracts think they are purchasing a concentrated mushroom fruit body extract powder, when in fact they are buying a mushroom fruit body extract that is dehydrated and sprayed back onto the spent marc without disclosing. This is deceptive.

Moreover, Nammex recommends using a questionable method for detecting beta glucans known to give widely disparate results. The beta glucan test that Nammex recommends is not currently a validated AOAC (Association of Official Agricultural Chemists) method for testing beta glucan content in mushroom ingredients in part due to its unreliability for consistent results. Furthermore, beta glucans are but one beneficial compound available within mushroom ingredients, and their presence alone does not indicate biological activity.

As experts, we continue to be concerned by confusion seeded by Nammex of widely accepted and settled terminology and are moved to write so that industry policies will be grounded in scientific accuracy. This is critical for clear and

sound regulations. We advocate for truth and scientific accuracy in labeling. In our opinion, Nammex’s proposals do neither.

We do not have any issues with mushroom fruit bodies. We utilize this life stage as well. We find mushroom mycelium has added benefits as demonstrated by scientific research. Please see [www.mushroomreferences.com](http://www.mushroomreferences.com) for hundreds of references published in peer reviewed journals for both mushroom mycelium and mushroom fruit bodies.

*Signatories of this letter are available to answer media, academic, or community questions.*

In unity, we respectfully submit,



Paul Stamets, Founder, Fungi Perfecti, LLC



David Law, CEO, Gourmet Mushrooms, Inc



Steve Farrar, Chief Technology Officer/Co-Founder  
M2 Ingredients/Om Mushrooms



Shah Kazemi, CEO, Monterey Mushrooms



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