THE All-in-One, Do-It-Yourself Learn-As-You-Grow GOURMET MUSHROOM KIT

A hands-on crash course in mushroom cultivation

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Dear Fungaian,

What a joy! You are a symbiont with the mycosphere.

This kit is meant to provide you everything you need to grow your own oyster mushrooms at home. As your mushrooms grow, so may your love of all things fungi. Hopefully this experience will inspire many future mycological endeavors. No matter how far you choose to wander down this path, there is truly no end to the knowledge that awaits your discovery.

This guide will get you started, but if you are new to mushroom cultivation and wish to pursue it further, the best first step is to invest in some well-rounded literature on the topic. Two great books filled with indispensable information for do-it-yourself mushroom growers are Radical Mycology by Peter McCoy and Organic Mushroom Farming and Mycoremediation by Tradd Cotter.

The enclosed liquid culture syringe contains living mushroom mycelium. You can store it in the refrigerator until you are ready. Use it promptly for best results.

Thank you for taking the time to learn, grow and share the joy of fungi. The world could use a lot more people like you. Keep it up!

Mush love...

In this kit you will find:

- A liquid culture syringe with a sterile needle
- A bag of sterilized, organic mushroom substrate and grains
- A small spray bottle
- Isopropyl alcohol wipes
- A plastic humidity tent

Contents

A Crash-Course in Mycology

Some Fundamentals

Mycology is the study of fungi. Some of the most adaptive and versatile organisms in the universe, fungi are a backbone of the biosphere and a cornerstone of civilization. As decomposers, they are the architects of succession, playing vital roles in the continuity of the cycles of life. Though they are intimately involved in nearly every living system, the intricacies of fungal ecology are still largely shrouded in mystery.

Mushrooms have been prized for their flavor, nutrition and medicinal benefit by nearly every culture in human history. The word "mushroom" is often used in a general sense to describe a fungus, but strictly speaking, a mushroom is actually an ephemeral *fruiting body,* a growth produced by a fungus for the purpose of reproduction.

While mushrooms usually emerge aboveground, the majority of the organism remains under the surface, or invisibly intermingled with plants. The bulk of a multicellular fungus is called *mycelium*. Mycelium is a dense network of microscopic cellular fibers, called *hyphae*. A single hypha is too small to see without a microscope, but when many are woven together to create mycelium, the fibers can be easily observed, often forming dense dendritic ribbons or cloud-like cottony tufts.

Cultivation Basics

Mushroom cultivation is a form of symbiosis. The cultivator sets the scene for fungal reproduction, and in return receives beneficial food-medicine. The basic process is simple. It begins with introducing either the spores or the mycelium of a chosen fungus into a prepared *substrate*, a mixture of the species' preferred food, such as hardwood sawdust or manure. This is called

inoculation. The inoculated substrate is *incubated* until fully grown, then it is either used to inoculate more substrate (called *spawning*), or else it is given a careful balance of light, humidity, warmth and airflow to encourage mushroom formation.

Liquid Culture

Mushrooms reproduce by *spore*. Spores are like seeds: each one is different. Mushrooms exhibit a remarkable amount of genetic variability. This is great for their long-term vitality, but leads to unreliable results for the cultivator. When a desirable culture is identified and isolated from innumerable possible spore combinations, it can be cloned indefinitely and raised to maturity with consistent success.

A good analogy is with apples: if you plant an apple seed, the chances are 10,000 to 1 that you will get sweet, tasty fruit. This is why apples grown for food are always *cloned*. A clone is genetically identical to its "mother," and retains the particular qualities of the fruit.

Typically, the cloning process takes place in petri dishes in a sterile laboratory setting. A single petri dish can be expanded by many orders of magnitude, and ultimately give rise to thousands of pounds of mushrooms and billions of new spores.

The most efficient way to expand a mushroom culture for cultivation is to make *liquid culture*: a single clone is fragmented in a nutritive broth and fermented with constant, vigorous agitation. The result is a dense slurry of separate, tiny clusters of cells.

When added to a prepared substrate like sterilized grain, sawdust or manure, this liquid creates thousands of distinct points of simultaneous initial growth. Invisible for the first days, the mycelium rapidly expands, finds its genetically

identical counterparts, and fuses back into a single organism. To the observer it appears to suddenly explode into life.

Because they are easy to use, keep well and can handle the rigors of transport, liquid culture syringes are the most affordable, reliable, convenient and efficient way to produce your own mushroom spawn at home.

Spawn & Substrate

Many of the mushroom varieties we know and love, such as oysters, are primary decomposers of dead trees, called *saprophytes*. For many centuries humans have been cultivating these delicious mushrooms by inoculating hardwood logs. However, the dense structure of the wood makes for slow growth, and it can take months to get results. A very common and much faster approach is to use a mix of sawdust and wood chips, as the mycelium can quickly grow throughout the loose mixture of smaller particles. This mix is also usually supplemented with additional nitrogen, which is a key ingredient for strong growth, such as wheat bran or soy hulls.

To speed the process along even more, mycelium is usually first given a running start on sterilized grains, called *grain spawn*. When used to inoculate a bulk substrate like sawdust, each grain serves as a leap-off point and a reservoir of nutrients so the mycelium can quickly envelop its new food source.

This kit is designed to guide you through a typical cultivation process, using liquid culture to inoculate grain spawn, then grain spawn to bulk substrate. To simplify the process, the grains and bulk substrate are layered in the same bag, so they can be inoculated and spawned without ever opening it, effectively combining two steps into one.

The grain is organic rye. The *Pleurotus* species included with this kit is a wood-loving fungus, so the base ingredient of the bulk substrate is hardwood

sawdust. It is mixed with various ingredients for additional nitrogen, minerality, pH balance, and structure. Water is the most important ingredient of all; since mushrooms, like people, are mostly made of the stuff, a properly hydrated substrate is key to producing a good crop.

The Conditions of Mushroom Formation

Once a substrate has been inoculated or "spawned," it is incubated until the mycelium envelops it completely. When fully grown, this substrate may either be used again as spawn—sometimes for numerous successive inoculations, to expand its biomass by several orders of magnitude—or it may be subjected to specific environmental conditions to induce mushroom formation. In many cases this simply means that the mycelial substrate is exposed to light and fresh, humid air. Some species require very specific environmental triggers, while others reproduce prolifically with indifference to circumstance.

There are many different strategies for inducing mushroom formation, or "fructification." The general idea is to simulate the events that precede fungal reproduction in the wild. One common technique is to fluctuate the ambient temperature much like the first deep chill of autumn, which small-scale mushroom growers do by simply placing the mycelium in a refrigerator overnight.

Another technique used widely in the shiitake industry is to apply a brief, high-voltage jolt of electricity, simulating the lightning that often attends a good rain. Though the underlying electro-biochemical mechanisms that make this work are not yet fully understood, it works nonetheless, and is remarkably effective.

One of the natural mushroom-formation triggers most relevant to indoor growers is that mycelium will usually seek to produce spores when it senses it

is running out of food and space. Oysters will often attempt to produce mushrooms in the bag.

The other primary factors needed to induce mushroom formation are light, humidity and airflow.

Contrary to common preconceptions, mushrooms need abundant light to grow. Direct sunlight will irradiate and harm raw mycelium, but indirect sunlight or daylight-spectrum indoor grow lights work well to provide the kind of diffuse light found in the shady forest understory where mushrooms typically abound.

Usually scarce in the dry seasons, some mushrooms need as much as 95-100% relative humidity during the early stages of their growth. Large-scale indoor mushroom growers use high-volume mist nozzles or powerful ultrasonic humidifiers to maintain a consistently humid fruiting environment. These conditions are often replicated on a small scale with a handheld spray bottle and a semi-closed environment like a plastic bag or storage tub.

Mycelium, like people, requires oxygen and produces carbon dioxide. Without fresh air, it can suffocate. Fine-tuning carbon dioxide levels is one of the most important factors in honing advanced and commercial-scale mushroom cultivation techniques, but for the purposes of the small-scale cultivator, simply ensuring constant or periodic ventilation is sufficient. Oysters require greater fresh air exchange than other varieties.

Striking a balance between maintaining high humidity and good airflow is one of the main “tricks” of the trade, and while most commercial cultivators rely on complex and high-tech feedback and control mechanisms, there is no substitute for developing a good, intuitive, working understanding of the relationships between these factors and mushroom growth. There is not a perfect, stable balance to achieve, as nothing in nature is ever so consistent,

and mushrooms generally benefit from periodic environmental fluctuations, allowing excess water to evaporate with moving air, then rehydrating, and so on.

Sterility

Why All the Fuss?

The basic principle of mushroom cultivation is to create the ideal conditions for fungal growth and then let the mycelium weave its magic. But there are many, many organisms that thrive in the same conditions, and not all of them are friendly. The most surefire way to grow a particular, desirable fungus is to give it a running start in a sterile environment, completely free of competition.

Like most organisms, a fungus is delicate and vulnerable during the earliest stages of its growth. Once it "grows up" and achieves sufficient biomass, it has a remarkable array of biochemical tools to ensure its survival.

The enclosed liquid culture is prepared under strictly sterile conditions, and the substrate is thoroughly sterilized with high-pressure steam. Outfitted with an injection port, you can inject the culture into the sterile environment inside the bag without opening it, thus circumventing the need for fancy laboratory equipment.

This technique almost always succeeds, but nonetheless care should be taken to minimize the chance of allowing any uninvited guests to crash your party. For best results, take the time to read and carefully follow the step-by-step instructions below.

Goof and Grow

A Note about Failure

When researching mushroom cultivation, newcomers to the field are often wooed and wowed with pictures of big beautiful mushrooms and abundant harvests, and there is a tacit conspiracy among professionals to make it look easy. It is not.

Mushroom cultivation involves numerous intricate steps, and in each one there is plenty of room for error. More art than science, it is a practice which requires foresight and intuition. Like any creative enterprise, failure is an inevitable part of the process.

Our culture instills in us an expectation of consistent success. There are specialists in every trade, if not masters, and we learn to leave the heavy lifting to the professionals. One of the great tragedies of this cultural landscape is that it discourages experimentation.

If everything were to work out just as we expect, what would be the point of trying? We are not automata, and neither are our fungal friends. It is too seldom said that any healthy, balanced approach to trying something new requires the acceptance of possible failure. Nothing can sap a passionate enthusiasm faster than disappointment, but taking strides in a new direction will always yield positive results, even if they are not readily apparent.

There is no shorter path to discovery, wisdom and joy than embracing uncertainty and trying something new. So hope for the best, prepare for the worst, and venture forth. To fail, and try again, and again—that is success.

Step 1: Inoculation

Before you begin, take a look at the bag of sterilized mushroom substrate (but leave it in the box). You'll see it has two layers, one of grain and the rest a mixture of sawdust and other supportive ingredients. It also has an air filter to allow for oxygen to enter without carrying any other spores along, and there is a rubber disc that will allow you to inject the culture into the bag without leaving an entrance for mold.

With painstaking effort to achieve total sterility, contamination is rare, but it does happen. Inspect the substrate for signs of mold. Look for small patches of green, gray or black. (Sometimes natural discoloration of the organic substrate can be mistaken for contamination, so if you're unsure, give it a couple of days to see if it grows. If you do find some mold, please send a picture along with your order confirmation for a replacement, and discard the unopened bag. Mold spores can be noxious so it's best just to avoid them.)

Create a clean workspace, free of drafty air. Wash your hands thoroughly. Leaving the bag of sterilized substrate in the box, lift the top corners of the bag to allow the grain to tumble down next to the substrate.

Wipe the surface of the rubber injection port with an alcohol swab to sanitize it. It's best to perform the inoculation quickly to provide the smallest possible window for ambient spores to find their way into the nutritious substrate.

Vigorously shake the syringe. (Hold the tube, not the plunger, or the plunger might pop out while you're shaking it.) As quickly and cleanly as possible, peel open the top of the sterile needle package just enough to expose the fitting, unscrew the syringe cap, and twist the needle onto the syringe. Avoid touching the tip of the syringe or the needle if you can.

Remove the cover from the needle and gently insert it through the center of the rubber plug into the bag.

CAUTION: The needle is extremely sharp! Take care not to tear any holes in the plastic, or yourself.

Steadily inject the contents of the syringe into the bag, distributing the liquid across the surface of the grains. Remove the needle gently to avoid peeling the rubber, then peel-and-stick the included tape over the hole for good measure.

Gently shake the whole box side-to-side to mix the liquid around in the grain layer. Thoroughly mixing the liquid culture at this early stage will dramatically accelerate the growth rate. Avoid breaking up and mixing the block just yet.

Step 2: Incubation

Place the box with your inoculated substrate in a warm place. 68-75ºF (20-24ºC) is ideal; much warmer than 90ºF (32ºC) can cook the mycelium, and below about 55ºF (13ºC) growth is slowed and can stall. Light is harmless but unnecessary during this phase of growth, and tends to encourage premature mushroom development. Avoid direct sunlight.

A perfect place for incubation, if you have one, is the cabinet above the refrigerator. Any comfortably warm, accessible and out-of-the-way place will do.

Growth should be visible within a few days, first appearing as little white tufts that expand and begin to interconnect. You can gently shake the grains around to mix them up once or twice during this first stage to accelerate

growth, but allow the mycelium to get comfortable with the grains before breaking up the whole substrate block.

After about 1-2 weeks, once the mycelium is visibly growing on a good portion of the grain layer, it's time to break up the block. Mixing the substrate disperses the incubating mycelium and allows it to grow quickly and evenly.

Lay the bag on the counter and gently but firmly loosen, break up and spread the contents along the length of the bag. Shake it up and down, turn it over, wiggle it around and whisper sweet nothings in its ear. Mashing the mycelium too aggressively or too often may be harmful, but disturbing it in this way invigorates and stimulates its growth. The goal is to mix the substrate thoroughly, evenly and with benevolent intentions.

Once mixed, grab the top of the bag and bounce it on the counter a few times to settle the substrate back to the bottom. Gently compress it back into a block so the mycelium can easily leap from one particle to the next. Flick the air filter and upper corners to shake off substrate that might have stuck there, then put the bag back in its happy place and watch as the mycelium proliferates.

One thorough mixing is usually sufficient. If after 5-10 days you see large, untouched patches of substrate, you can try another break-and-shake.

After about 2 to 4 weeks of incubation, the whole substrate block should be enveloped by white mycelium and is ready to produce some mushrooms!

If left too long in the bag, you may notice the mycelium accumulate a yellowish fluid. This metabolic byproduct is not harmful, but usually shows that the mycelium is ready for something new. If your block is fully incubated but you have to, say, leave town for a month or two, you can get away with putting it in the refrigerator.

Step 3: Tending the Crop

When you think your mycelium is ready to enter its next phase of growth, there are a few ways to go about it. It needs fresh air, plenty of indirect light and lots of moisture to grow best. If you provide these conditions, mushrooms will be soon to follow.

First, you'll cut a hole in the bag for the mushrooms to emerge from. Take the bag out of the box and stand it upright on the counter. Poke a small hole in the corner, then roll the top down tightly to press out all the air. Use a piece of tape or some rubber bands to keep it tightly closed. (Leaving pockets of air in the bag will allow mushrooms to form where you don't want them to.)

Put the mycelium back in the box and press it firmly to the edges. Use a box cutter or sharp knife to cut an X-shaped slit into the mycelium, about 2-3 inches (5-8 cm) across. (Many growers like to experiment with the number and size of the holes. The X shape is a good place to start, as it allows the mushroom to push the plastic open as it grows.)

Stand the flaps of the box upright, and stretch the enclosed plastic tent over the open box. This tent will help keep the mushrooms from drying out.

Use the small mister provided with this kit to lightly moisten the emerging mushrooms 2-3 times per day or more. The key to great mushrooms is water. Too much moisture can lead to mold and rot, but with too little the mushrooms dry out and stop growing. If they begin to turn brown, this is usually a sign they are too dry.

The mycelium will respond to contact with the air, and over the course of the next few days you will see your oyster mushrooms begin to emerge from the hole in the bag. First appearing as white lumps, they will grow noticeably from day to day and begin to develop spore-bearing spines.

Mushrooms love oxygen. The key to producing great mushrooms is allowing them plenty of fresh air, while still keeping them moist. If you live in a humid climate, this should be no trouble, but if you live in an especially dry area you'll need to tinker to find an ideal balance.

Adjust the height of the plastic tent to allow more or less air into the holes in the corners between the flaps of the box. Leaving these gaps open about 1 inch is a good starting place. If you need more air, you can roll the tent up so that it just sits on top like a hat, and even cut more holes in the box. To retain more moisture, pull the tent all the way down, or even place a damp paper towel or clean sponge inside the humidity chamber.

Tip: If your mushrooms dry out or stop growing for some reason, or after multiple harvests, you can remove any dried growth and use clear packing tape to seal the hole. Then simply cut a new one on the other side of the bag.

Addressing Contamination

While your mushrooms are growing, it can't hurt to keep an eye out for mold. Oyster mushrooms are generally quite at home with other fungi, but it's usually not something you want in your kitchen. Many newcomers to mushroom cultivation are scared off by a general atmosphere of panic regarding mold in the commercial mushroom cultivation community, but for the home grower it is a far less troublesome concern. Nonetheless, a tiny spot of mold can spread quickly, so it's best to nip it in the bud.

Hydrogen peroxide is the best treatment, because it destroys spores and single-celled organisms but the mycelium, which naturally produces its own peroxides, will be able to neutralize it with no ill effect. Add a capful of standard household-strength hydrogen peroxide to the mister, top it off with water, and give the moldy spot a firm blast. If it fizzes, the peroxide is doing its work. Avoid spraying too much peroxide on the mushroom itself, as it can be

harmful in larger amounts. You can also attempt to cut away the contaminated area with a clean, sharp knife.

Keep an eye on it and repeat this spot treatment if necessary. If it keeps coming back with a vengeance, you may have to discard the substrate and try again. Some mold spores can be noxious, especially if you are prone to allergies, but a little bit here and there is usually tolerable, as is often seen on wild specimens (not to mention all over the kitchen). Many folks pay it no mind, and simply rinse it off the mushrooms just prior to cooking.

By closely following the techniques outlined in this guide, mold contamination is rare. But mold spores are everywhere, especially in kitchens, and this is where the rubber really meets the road in mushroom cultivation. In the long run, every mushroom cultivator will inevitably encounter these *fungi imperfecti*, so don't let it discourage you if you do. Just take a break, give it some time, go find some wild mushrooms in the forest, and let yourself fall in love with the process again. It will make the fruits of your future success all the sweeter.

Step 4: Harvest

Your oyster mushrooms should be ready to harvest after about 10-15 days. As they mature, the caps begin to uncurl. Most folks harvest when the caps are just slightly upturned, while the mushrooms are still young, as this ensures the longest shelf life, but you can let them grow long and leggy if you like.

To harvest the mushrooms, you can simply grasp the whole cluster and twist it free of the mycelium. Some folks prefer to slice it off using a very sharp knife. Either way, be careful not to bruise the remaining portion or you may encourage bacterial decay.

When harvested properly, oyster mushrooms will regrow repeatedly from the same opening. A well-formulated substrate contains enough nutrients to sustain multiple consecutive harvests before the growth slows and the fungus begins to yield to succession. Typically, each harvest, or "flush," is slightly smaller than the last, but this kit may produce as many as 3 or 4 rounds before other organisms start to take over. Then the mycelium will need to be moved outside. See some ideas for using spent substrate in the "Next Steps" section below.

Storage

Freshly harvested mushrooms retain metabolic heat, and are noticeably warm to the touch. Chilling them rapidly will prolong their shelf life. They sweat, especially as they first cool, and continue to breathe, which is why they are usually stored in the refrigerator in a kraft paper bag. They will readily absorb odors from other stored foods, so another good method is to line an airtight food storage container with kraft paper instead. (Store-bought mushrooms are also sometimes sold in plastic wrap, but this is actually a specialty, engineered packaging system, and mushrooms wrapped in typical cling wrap will soon turn to mush.)

Fresh mushrooms are actually still very much alive. If stored well but left too long, they may "fuzz out" and begin slowly converting their own biomass into new mycelium. They are still safe to eat at this stage, but the texture becomes strange. They may also begin to grow into and digest the paper bag.

Step 5: Chow

Oyster mushrooms are among the most nutritious, delicious and medicinally beneficial foods on Earth. There are many fantastic recipes for cooking with these special mushrooms, but sometimes the simplest method is the best way to truly savor the delicacy of the ever-so-well-deserved fruits of your labor:

Using your clean, bare hands, tear the oysters into slivers. Start at the cap, and tear them lengthwise to the stem. Toss them in a hot skillet over medium heat. Add a dash of water or wine to get the steam going, and put a lid on for a minute or two, until they render their juices. Remove the lid, bump up the heat, and stir, letting the moisture steam off. Then drop in a pad of butter (or a skein of oil), and perhaps a bit of fresh garlic, and brown them up a bit. They don't need long, and you don't want to spoil the crunch. Finish them off with a pinch of salt and perhaps a sprinkle of fresh thyme. Pull them quick and eat them hot, with your fingers and your friends, before bothering with any formal meal arrangements.

Next Steps

When it comes to fungi, the end is just the beginning. Here are some ways to continue the journey after your first harvest:

- ➔ Start an outdoor mushroom bed

When the mycelium has begun to exhaust its substrate, it can be mulched, composted or fed with more wood shavings and paper waste to continue growing outside. An easy experiment is to use the cardboard box this kit came in: peel the tape off, soak it thoroughly with water, let it drain, then fill it with your spent substrate and bury it under mulch in a shady, irrigated corner of the yard.

➔ Inoculate a log

Your mycelium can be used to inoculate a freshly cut hardwood log. (Conifers are generally too resinous to support the growth of gourmet mushroom species.) A 3-foot (1m) log of 4-8 inches diameter is an ideal size. Use a half-inch (12mm) drill bit to make numerous holes into the center of the log, spaced a few inches apart. Break up and crumble the mycelium with your fingers, then use a funnel and a stick or dowel to stuff it deep into the holes. Use a candle to drip a thin layer of wax to seal the holes and the cut ends of the log, then store it off the ground to incubate. If you live in a cold climate, you can keep it in a cellar or greenhouse through the winter. Place the incubated log in a shady, well-irrigated corner of the yard and keep an eye out for mushrooms, especially after rain in the spring and fall.

➔ Refill your kit, or take it to the next level

You can get more mushroom cultures, kits, and supplies, by donation, at:

www.fungaia.life

Fungaia is a heart-centered, donation-based mushroom company, driven by deep passion and a vision for sustainable symbiosis. Firmly rooted in a do-it-yourself ethos, we endeavor to demystify fungi and make mushroom cultivation accessible to newcomers and lifelong mycophiles alike.

From unique learn-as-you-grow mushroom kits, to educational and consultation services, to our lifelong dream of Free School, we live and breathe creative education. We believe that fungi are the finest teachers, and some of our greatest allies in the quest for prosperity—both our own and that of the living planet we call home.

Your support means the world to us and helps to sustain our vision. If you have any thoughts, questions or issues, please get in touch. We're here to help, and we'd love to hear from you!

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