

Understanding nature's life cycle is the key to understanding the planet and humanity. With this thought in mind I set out to explore and convey the depth of humanity's roots in nature.

I used oil paint in attempt to capture the memory of my uncle Josh, a man I never got to meet. I chose him because I feel as though I knew him, as though the stories people have told me are my own memories, though he died in a car crash when he was 17. He is complex to me, and the memories of him far more so. I use him as a metaphor for the far-reaching influences of human lives on one another. I believe his death was not in vain because beyond the nutrients he brought to the earth, he left an impression, yielding growth and creation.

Out from the painting of my uncle, fungi seemingly decay the canvas. This decomposition speaks to the cycling of life force and new life that fruits from it. Fungi offer incredible insights and guidance to the development of human civilization. I want people to understand that life and death recognize and support one another other. Death, of any kind, is a new beginning of another's life. There is an interconnected web that weaves us together and we are as much a part of earth's system as fungi, and to survive on this planet we must think alike. We are simply dirt aided by fungi, and that is the way it should be.

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Abstract:

The mysteries of fungi were never of interest to me until recently. My interest began merely from a conversation and snowballed into an obsession for the past two weeks. I have grown to believe that fungi are vital to our survival, and that is what I attempt to convey in this paper. I researched and read on a lot of topics, such as fungi, mycelium, soil, pollution, solutions, death, and decay. I covered a vast range of sciences in my search. Though the theories seem primitive, they are quite the opposite. I discovered well founded, innovative, and insightful solutions to the ecological degradation our planet is in. the overarching theme through out my research is that, nature's life cycle is the key to understanding the planet and our selves.

Like the tail of a turkey displayed during mating season, the white scalloped fungi sprouted from the tree. This monstrous, but beautiful mushroom was unknown to me. I remember my father documenting the natural condition of the plume, and then plucking it from the bark. He called it Mama Shroom on the walk home, but once settled on the porch he decided her name was Sujata. Sujata was the woman who gave Siddhartha a bowl of rice when he was experimenting with extremist deprivation; saving his life. My father felt that some force offered the pearly mushroom to us, as the bowl of rice was to Siddhartha. Though the mushroom was never consumed nor did it save either of our lives, it brought another life form to my attention. Sujata rests on the wall of our cabin in upstate New York to this day. She is a shriveled old woman now, but her essence is still apparent. I found a human element in Sujata. Not only did her name challenge my ideas of a mushroom as an inanimate plant, but also for the first time in my life I felt life in a plant. I know now that she wasn't a plant. Fungi are another category entirely, and I myself am more closely related to fungi than plants. Fungi hold a mystery that feels beyond this world. They are a key organism to our earth's function, and we are truly dependent on them aware or unaware. We, however, should be even more entangled in mushroom life. Mushrooms have fantastic powers that are not only fascinating but can solve a lot of our problems. If only humans would let them.

The human touch on our planet is far more destructive than the fungi's. We as a civilization have created a system that does not involve nature as a willing participant, but rather as a resource never to be reimbursed. In order to create comfortable lives for those with money, to keep their homes and lives clean, we strip soil and organisms from earth's surface and guzzle its water. We use, and then throw away. It is no cycle. The "fresh and new" thrive on this planet, but for a day, and then are dumped on an island in the ocean along with decades of immortal trash. The want for not only survival, but of idealist cleanliness and agelessness, is what is destroying our planet. A new plastic bottle for a new shampoo, a new Styrofoam casing to protect new shoes, and a new fork to replace the one that touched the ground for a second. It is an irrational culture we have built. We consider the old and dirty to be a primitive way of life.

The human race has risen above the days of personal agriculture and outhouses. We have made it easy for those with money to never be hindered by the sight of nature's cycle. And at this point in time, the people in charge have no want to change this system, because it profits them. It is the wealthy that control our planet's health and they have fostered a throw away culture that only helps their expansion. The message that society sends us is that we are living in an advanced world and that progression on this ever-expanding path will lead to happiness. Our "high-tech" world is not that at all. In fact, the ideas we consider primitive are the most profitable in the long run. Our fears of death and decay are the most primeval of all. To make the best of our civilization we must embrace our fears, for they do not profit only us but all of Gaia. And how can we do this in a constructive manner?

The answers are hard to comprehend without understanding our current role on earth. We were originally part of nature's cycle, but we are no longer part of that cycle. Some might say we have evolved to a higher life, but some might also say that the toxic lives we live are crude and childish. We demand all from our earth and like a mother she provides, there is no exchange in goods, only the knowledge that one-day the child will surpass the mother. Our surpassing will not be a momentous occasion to celebrate. By the time we pass her almighty plans and destroy her hopes and dreams, our race will no long

we able to inhabit its host. We approach that date, and rather than attempt to reverse our drain of nutrients, we count dollar bills and continue to procreate. This is because the answer to our problems is not in our god given brains, but in the soil bellow us. The deeper we dig into our mother the closer to our humanity we become. This would be the smartest thing to do, but since our culture has endorsed the fear of weakness and death and decay we cannot seem to accept the soils help.

This fear, the fear of decomposition and decay, is contradictory to productivity. It is to this fear we can accredit the first factory and first war. Things that may have seemed successful at the time, but have only lessened us as a species; by separating us from earth. If we truly understood the benefits of the cycle of life, maybe we wouldn't strive so hard to stop it. The aid to death is fungi. We have grown to understand at least this, but few have delved deeper into fungi to draw knowledge from it. The fear of decay has created a superstitious fear of fungi. On some level, almost everyone has a negative perception of fungus. Some may think hatred of fungi is about its appearance and foreign shapes, but I believe it is about the fear of our own bodily decomposition. William Delisle Hay was the first mycologist to speak of fungalphobia. He writes, "[mushrooms]... are lumped together in one sweeping condemnation. They are looked upon as vegetable vermin only made to be destroyed. [...] the individual who desires to engage in the study of them must boldly face a good deal of scorn. He is laughed at for his strange taste among the better classes and is actually regarded as a sort of idiot among the lower orders. No fad or hobby is esteemed so contemptible as that of 'fungus-hunter,' or 'toadstool-eater.'" <sup>6</sup> People are afraid of what is unknown, and mushrooms tend to be the very unknown.

I did not pick up on my own hesitation to touch the rotting or even a wild mushroom before researching this topic. I have come to understand that fungi are deeply related to all things, physical, historical, and mental. There is a connection between our lives and the fungi's, an unknown interaction. Yet we still distrust the spores that eat our decomposing bodies. Suspicion is associated with their form, and related to death. The associations and connotations with fungi have led to disharmony. Disharmony with the planet, but also among humans. The fear of decomposition is related to the ecological degradation, but also the degradation of classes and races. We connect dirt with decay, and therefore the wealthy connect decay with the poor and native. Separating themselves from the sick and filthy only makes the gap between classes wider. This has been a major issue in the past with factory workers, and today with immigrants. Trump perceives the invasion of immigrants as the invasion of fungi decomposing his own body and life goals along with it. His will to survive and fear of death prevent him from rational thought. This is the way with most humans, but once understood, can be the solution to our problems as a race.

Embracing decomposition and specifically fungi can save us from the hastening doom ecological devastation. The love of fungi is no longer a primitive thing, it is of the future. Fast fashion and unspoiled beauty are antiquated ideas that still linger. But people are starting to take responsibility for the planet we inhabit and are creating solutions to big industry problems.

To talk about the solutions fungi hold, we must understand their current role in our planet. Fungi are a mystery. They were the first organisms to come to land, followed by plants thousands of years later. For tens of millions of years, the earth was dotted with massive fungi, called Prototaxidies. At the time, these were the largest organisms on earth. 65 million years ago an asteroid crashed into earth and the debris blocked the sunlight. For

this time, fungi took over the earth because they use radiation as an energy source. Those that paired with the thriving matter benefited, and have a symbiotic relationship today.<sup>11</sup> In ancient Egypt, they were thought to have magical powers and therefore be the food of the pharaohs and solely the pharaohs. In other lands, mushrooms were thought to “produce super human strength and aid in the connection between heaven and earth.” Later, kings in France and then England cultivated them for personal use.<sup>4</sup> The wild mushroom and commercial mushroom started to separate in appearance and association. The mushrooms we eat today are just the fruit of a fungi root system that is what holds our ecosystems together. Midst the soil grows mycelium. Mycelium is a network that connects all plants. It is the white fabric that creates good soil.

Fungi sporulate from the fruiting mushroom, then germinate, and then the mycelium goes underground. It grows fast and makes connections as it grows to form a web and support system. Mycelium is the earth’s Internet, an extension of our membrane. Our Internet is just a replica of our ancestor’s original model.<sup>10</sup> Some believe that subconsciously we mimicked the Internet of earth when creating the Internet of mind and information. Mycelium goes farther than our earth; their network and structure are mirrored in dark matter. Mycelium has a connection to space and the form of our galaxy. The question arises, are mushrooms an alien organism? Some believe so, and have speculated theories of their take over millions of years ago. They are the most intelligent organism on our planet, but most importantly, the most beneficial.

Fungi aren’t solely sources of nutrients. They can tackle worldly tasks as well. To change our outlook on decay, and also save our planet, people must become aware of the products and abilities of fungi. Without the stigma normally attached to decay and without the concept that humans can design better than nature, our earth could begin healing the wounds we inflict.

By far one of the largest scars we leave on earth is pollution. Pollutants can be anything that is leaving an irreversible impact on the environment, such as trash or oil. Tackling oil first, mycologist Paul Stamets proved that fungi, specifically mycelium, can clean oil and toxic pollution. In a test he conducted, he found that mycelium absorbs and uses oil as fuel. The mycelium breaks the hydrocarbon bonds then converts them into fungal sugars. The sugars then aid in the rapid and healthy growth of mushrooms. The mushrooms then bring other life and create an oasis where oil once was. Stamets then had the idea to create simply designed mycelium blocks wrapped in burlap sacks to then be placed near polluted areas. These packs reduce the number of coliform bacteria, a bacteria commonly used as an indicator of food and water quality, a thousand times over.<sup>11</sup> Stamets proved and then executed a theory that place mycelium, a renewable source, as our best bet in containing and reversing oil and other toxic leakage. Yet mycelium is still not the most popular way of reducing ground pollution, why? I believe it is because we hold our own intelligence over Mother Nature’s.

Stamets has perused the theory that fungi hold more than just one answer to our numerous problems his entire life, including disease and the pollution of pesticides. He speculated that we share the same pathogens as fungi, because like us, fungi do not benefit from bacterial attacks. Because of this trait some of our best antibiotics come from mushrooms. Stamets then used a rare mushroom found in only old growth forests to produce a cure for smallpox and then tested it on flu viruses. His results were impressive. This led him to apply his research to other microbial parts. He then found a way to prevent

insects from eating his house. He morphed a specific mushroom culture into a non-sporulating form, which attracts the carpenter ants and termites. A week or so passes and the ants then become mummified by the now sporulating fungi they ate. Very soon a mushroom grows from their dead body. After this sporulation, the house becomes unsuitable for reentry by the insects and the problem is solved. He then used this idea to create a way of steering insects, using fungi to prevent the thriving of insects in a specific area.<sup>11</sup> This whole concept could massively change the pesticide industry. Small companies manipulating fungi forms to kill insects could replace the corporations that have spent millions to create toxic chemicals that do the same job. If this concept was taken seriously and refined, no longer would poisonous pesticides be sprayed in the air to mass-produce food. Maybe if we start changing the way vegetables are grown, we will start changing the way they are disposed. The entire food industry could become more sustainable.

Growing food for the billions of humans, and the animals that feed humans, on this planet has become extremely draining. The soil producing food can no longer be considered “good” by the soil food web standards. As big food producers drain nutrients from the soil, chemical fertilizers attempt to replace them. Our current fertilizers rely enormously on massive amounts of phosphorus. Plants are only able to use 15% of this phosphorus. The runoff of phosphorus flows into water supplies and feeds the growth of blue algae, a plant that releases toxins and can lead to health issues. According to biologist Mohamed Hijri, peak phosphorus use will be in 2030, less than 15 years away. By the end of the century, we will not have any phosphorus left. Our reliance on this chemical to grow our food will cause a major agricultural crisis. Hijri is proposing a new fertilizer. Crops grown with mycorrhiza can absorb more phosphorus and postpone an agriculture collapse.<sup>3</sup> It is a simple short-term solution to phosphorus run off, but the concept of encouraging symbiotic relationships can be endlessly beneficial.

At our current state we cannot offer anything to earth, it is a parasitic relationship. Our dependency on a fuel source, currently oil, is so strong that denying fuel to civilization would bring systems to a screeching halt though it would save earth. Paul Stamets found another use for fungi that would aid our need for fuel, but renewably. Following a corn mycelium experiment he did, Stamets realized he could make fuel from mushroom processes. Making ethanol from cellulose using mycelium as an intermediary, and created Econol.<sup>11</sup> Econol would help turn our energy crisis around. Pollution from oil would no longer be an issue if a massive scale production of Econol took place. To change our fuel system would be extremely expensive and tedious, but to save future generations, it is worthwhile.

Other scientists are thinking of the future as well, but with a more founded plan. Eben Bayer, co-founder of a company called MycoBond, is also working to stop pollution and change fuel consumption. He uses mycelium to turn agriwaste into a foam like plastic insulator. This plastic could potentially replace the current system of waste being landfilled. At the end of this new plastic’s life, it could be composted and the earth would even benefit from its addition. The idea is to give into nature’s recycling system, fungi, and utilize it to reduce our oil use in production. This can also save our earth from Styrofoam build up. The process of making this packaging is slower than our current materials, normally takes 5 days. However, it can be created from multiple sources of agriwaste. Bayer made an adaptable business model that can fit into any countries’ environment.<sup>2</sup> Bayer’s product is similar to Paul Stamets’ life box. The life box is a reinvention of the

delivery system by way of using cardboard packaging with mycelium and nutrients inoculated into it. These boxes are compostable and even deliver nutrients to the soil, similar to Bayer's.<sup>11</sup> These two projects are essentially the same in concept, but differ in design. Bayer's plans are currently more prosperous because he built a sustainable mycelium plastic alternative to the islands of trash in the ocean, and the plastic can be made anywhere in the world. Bayer's company is currently producing, and it can change the plastic industry if people take responsibility for their planet, specifically their trash.

The most ingenious of the fungi related inventions so far, challenges more than our perception of mushrooms, but also our mortality. Artist Jae Rhim Lee designed a mushroom burial suit that I personally intend to wear. In most ground burials, the body is filled with formaldehyde and covered in fillers and cosmetics. Over the years, this leeches toxins into the earth, especially when incased in a bleached, painted, and chemically treated box. Even if a body is cremated, the toxins are released into the air and traces are left behind in the ashes. Lee's suit reverses the damages of toxins and prevents them from contaminating the earth. The suit is embedded with spores of her own creation. She calls this unique fungus the "infinity mushroom," created through selecting the best decomposers. The mushrooms aid decomposition and use the toxins as food. Lee is working on testing the suit and creating "decompiculture" burial kits. Lee is attempting to change the way our society views death and decomposition. She works to understand and help culture accept death while also lessening our negative impact on the environment. She, wants to change our current culture of death denial and body preservation to one of "decompiculture." "Decompiculture" means accepting our physical form and its impacts on the environment.<sup>7</sup> I see an age of environmental responsibility on the horizon. Soon solutions such as these will be truly necessary for survival. I say we embrace the mushroom today, before it is too late.

"Decompiculture" is really the first thing we must accept. To fix the planet we have to work not as individuals, but as a collective. Our singular deaths have an impact on the trillions of other organism on this earth. Becoming aware of our mortality is the first step to changing the structure and process of human society. To progress as a species we must allow the progression of other species. Fungi are our true saviors, but a fungi future means a massive over hall in our relationship with death. It is fungi that will utilize our bodies in the future. To change our fear of death and decay is simpler said than done. Changing our impact on the environment will alter our consciousness immensely, but still, how can our fears be overcome and used to profit us? The solution to this problem lies in cultural influence. We will never live like the bee, all sacrificing for the good of the hive, but our culture can at least cultivate and elevate the need for collective thinkers.

Think fungal. No longer should a "dirty hippie" be associated with fungi exploration, because it is a truly sophisticated approach to the earth crisis. Fungi utilize all nutrients and resources, but do not conquer and destroy, as well do. The nature of fungi is to work with other organism to create the optimal ecosystem. The manner in which fungi interact with the earth is something to aspire to, but the human race should also listen to the lessons of fungi and bring peace and harmony to human interaction. We have to act compassionately and end strife to ever thrive within the nature's system. Plants and fungi have weathered evolution, we are their only threat now, but in fact we might be on the brink of extinction by our own hand. Plants only survived because they work with the elements, and we do the opposite. To last as a species, the society of mushrooms should

inform our own society. We have to reorient our trajectory, not to be the best but the most in sync. Our product development and agricultural industry have to go forth with the enlightenment of mycelium. Capitalist America must understand that our survival is reliant on comprehending nature's cycle to the fullest. The future is a biometric approach to the design of products and systems. Human industry modeled after nature's processes, seeing materials as nutrients. New companies are being formed with these business models; it is now up to the people to make a real shift.

Fungi are the key. Our own fears are getting in the way of fungal progression. To create a more "complete" civilization, input from nature is necessary. We are at a place as a culture that is really disappointing. Majority of the people on earth do not understand the natural world around them, and don't feel compelled to explore it or can't. This leaves a select few with the responsibility of maintaining the planet. Unfortunately those few have no interest in anything but personal profit. Our new model for civilization should be a compost pile. The entirety of humanity working together to not just survive, but thrive. Life and death understand and supporting each other. I now wonder what my own personal role is with in the compost heap, to bring awareness? Use only products produced with nature's business model? Discover new solutions? My current role in society is that of consumer, like majority of humanity, so it is our job to create the demand for sustainability. If everyone wants to save the earth, the industry will shift. We are but dirt aided by fungi, and that is the way it should be.



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