The Lands Council Presents...

Mycoremediation

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Special Projects and Outreach Coordin

THE LANDS COUNCIL 25 W. MAIN, STE 222 SPOKANE, WA 99201 (509) 209-2851

The Lands Council

Environmental Non-Profit
Spokane, WA

We preserve and revitalize Inland Northwest forests, water, and wildlife through advocacy, education, effective action, and community engagement.

We collaborate with a broad range of interested parties to seek smart and mutually respectful solutions to environment and health issues.

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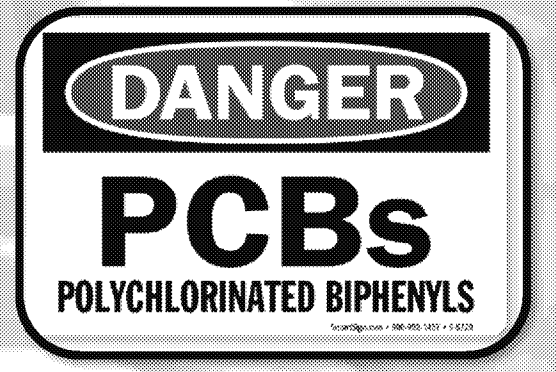
Project Development

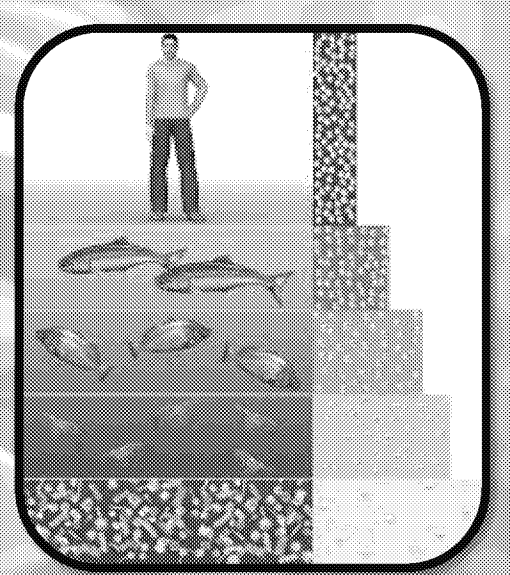
PCBs & the Spokane River:

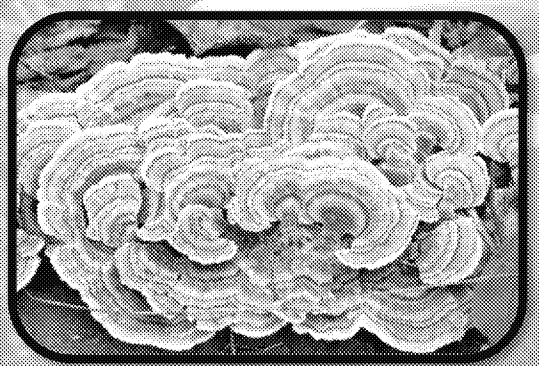
- Challenging issue
- 209 congeners (legacy/ inadvertant)
- Many sources and pathways
- Persistent
- Bioaccumulate
- Toxic



Current/ Industrial clean up methods:

- expensive
- huge environmental impacts
- only moving the PCBs, not destroying them





Is there a natural solution?

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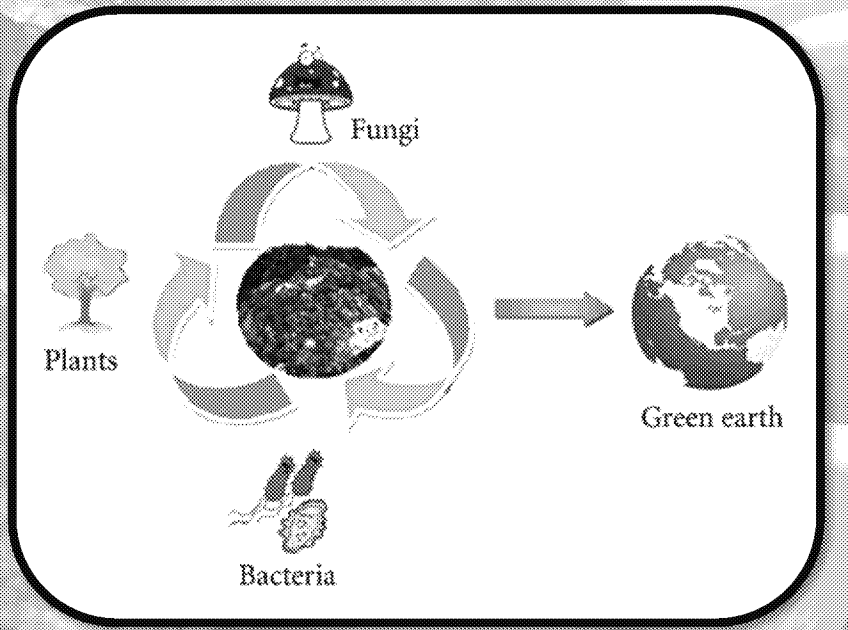
What is Mycoremediation?



"Bioremediation"

using naturally occurring organisms to detoxify the environment

"Mycoremediation"

using fungi (mushrooms) to detoxify the environment

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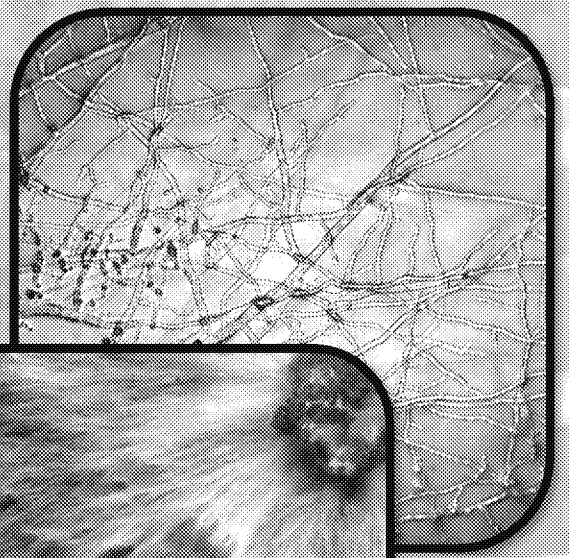
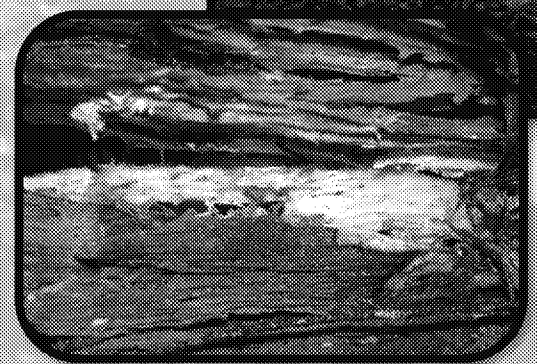
Intro to Fungi

Mycelium- vegetative body of a fungus; growth & digestion





Mushroom- reproductive fruit of a fungus, emerges from mycelium, spreads spores

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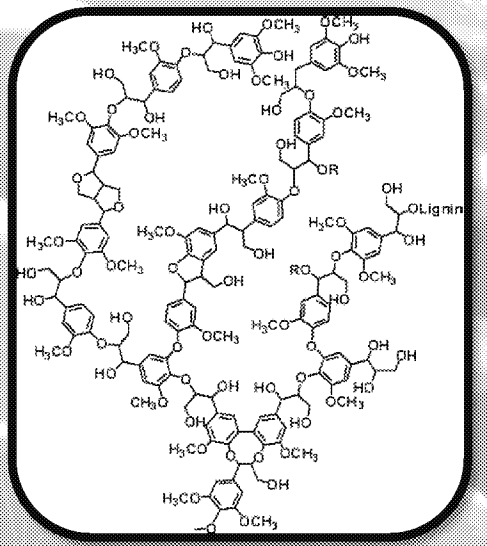
Fungi as Decomposers

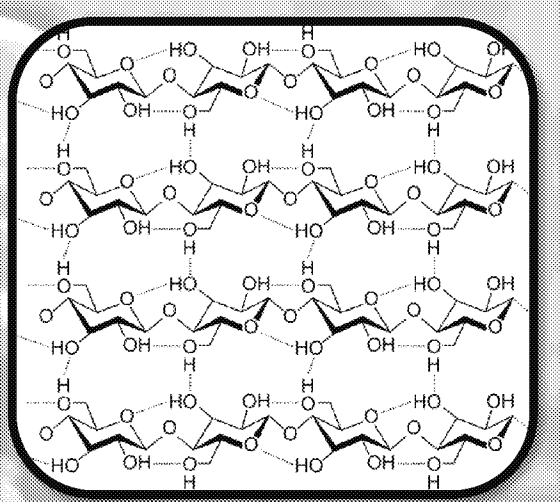
-Important for nutrient cycling

-External digestion

-Powerful enzymes for digesting wood



Lignin



Cellulose

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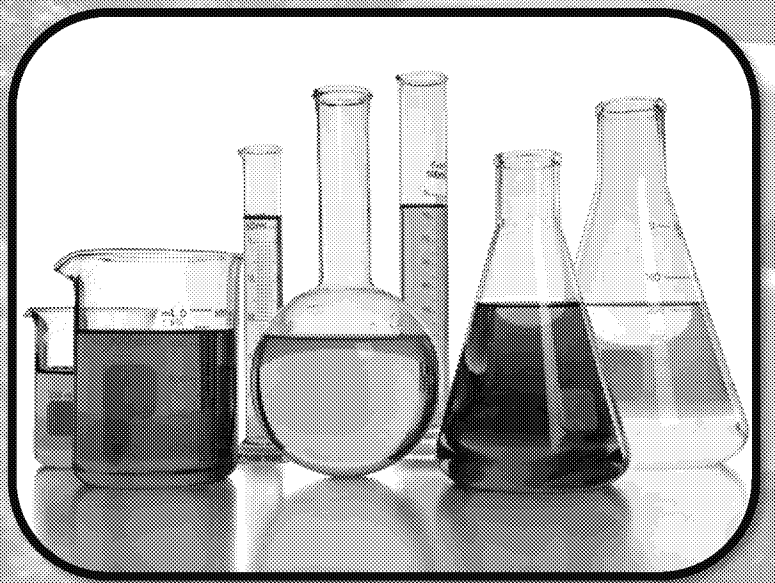
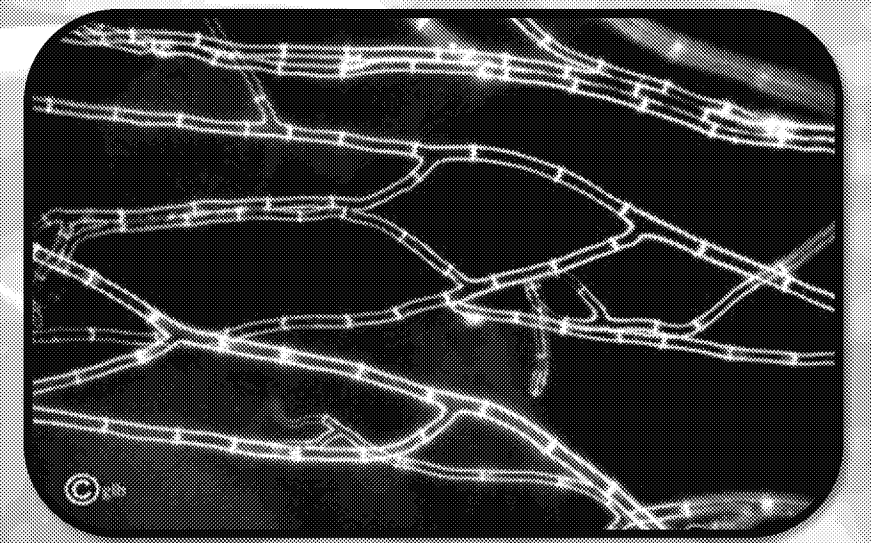
Mushrooms Eat Chemicals..?!

Some toxins have a similar chemical structure to lignin, and can be digested by the same enzymes!





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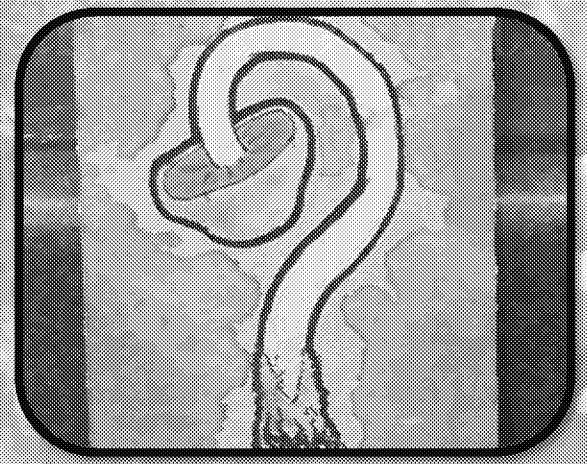
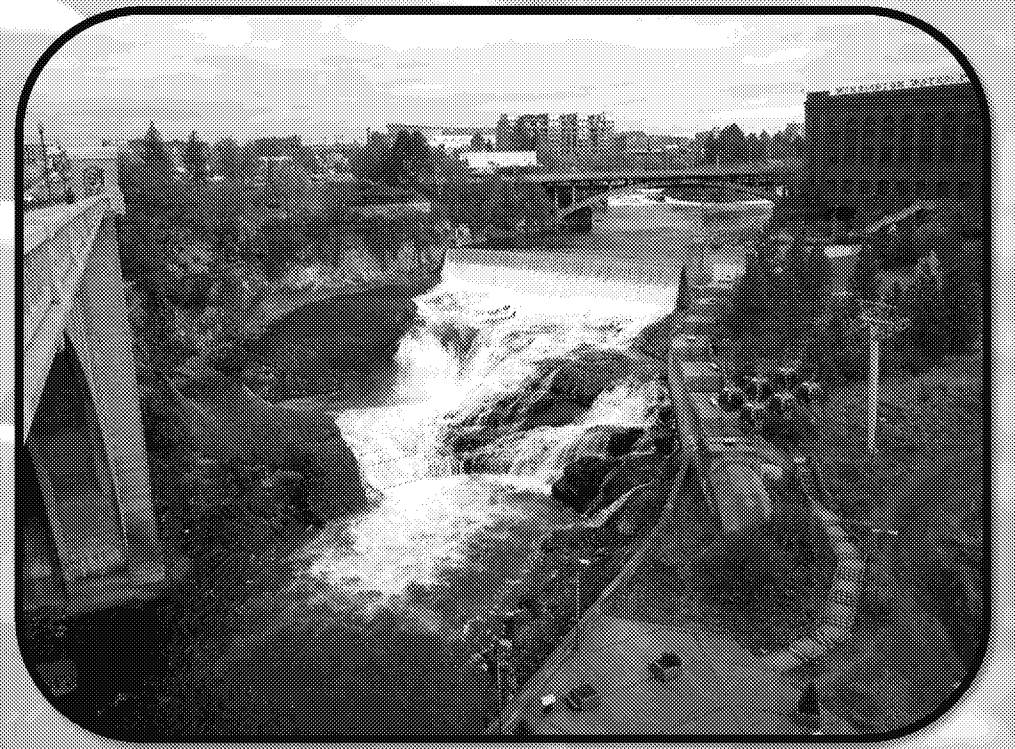
TLC's Hypothesis



Research shows some fungi can digest PCBs!

Can we use fungi to detoxify PCBs that threaten the Spokane River?



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Mycology Program

- TLCs newest program
- Partnered with Fulcrum Institute and received a Community Development Block Grant to build new Lab
  - ESD101 construction
- Partnered with the City of Spokane to conduct the first Mycoremediation experiment in Spokane

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Vactor Waste Experiment

- The Lands Council & the City of Spokane
- Vactor Waste (storm drain sludge) contains PCBs and other pollutants
  - Growing 8 species of fungi
    - "Feed" them Vactor Waste
  - Observe growth and test for PCB reduction
- Groundbreaking research
  - Few real world mycoremediation projects

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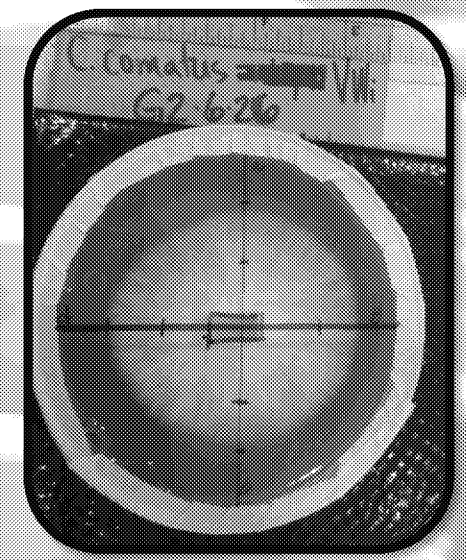
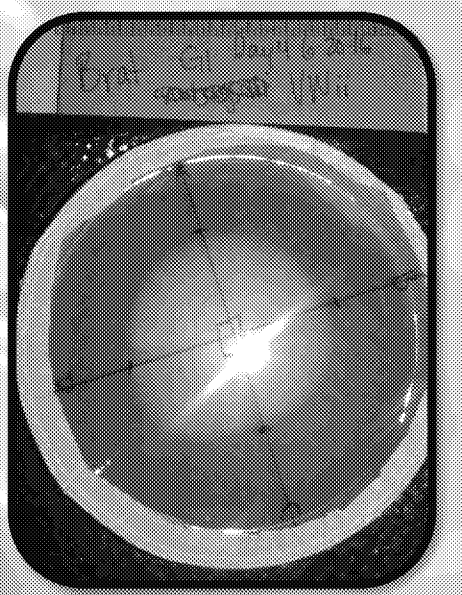
Step 1: Introducing Fungi to Vactor Waste

- Fungi can 'learn' to digest different food sources
  - "Enzymatic memory"





- Vactor Waste-spiked Petri dishes
  - Recorded growth
    - Chart
    - Photos
  - Chose fastest growth

						Axis in millimeters			
Date	Day#	species	Generation	media	dish #	A	B	C	D
20-Jun	Day 4	C comatus H creek	G1	nutag	i		25	24	13	8
					ii		22	24	23	22
					iii		9	19	14	11
				VW	i		20	21	18	22
					ii		21	24	18	21
					iii		25	29	26	25
		G frondosa Olga	G1	nutag	i		10	9	9	9
					ii		5	7	5	6
					iii		7	4	8	6
				VW	i		10	8	9	9
					ii		11	9	8	12
					iii		8	9	9	9

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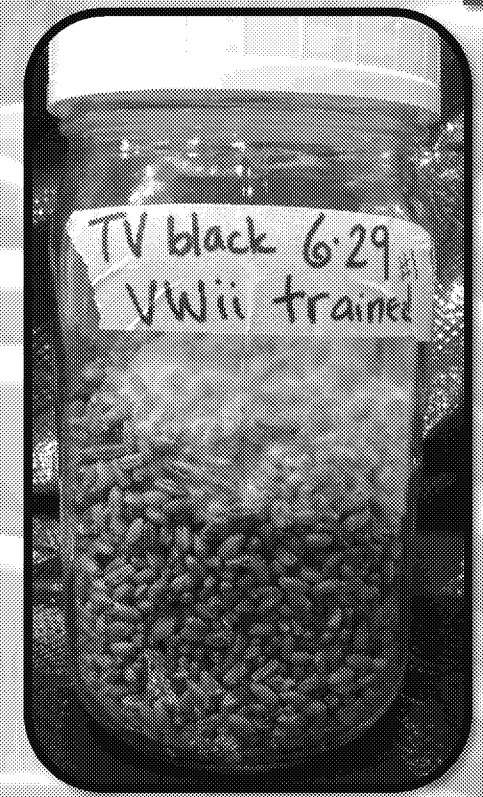
Step 2: Grain Spawn

- Each species: 2 jars of hydrated/ sterilized grain
- Incubated at 75 degrees F for one month
- Recorded growth
  - Chart
  - Photos
- Chose fastest growth



Date: July 11, 2016 Day 12	Jar #1			
	% growth on grain surface			
Species	Upper	vertical	base	density (i, ii, iii)
Coprinus comatus hunter creek	60	10	0	ii
Grifola frondosa	60	20	0	i
Lentinula edodes	70	30	0	i
Pleurotus ostreatus brat	100	50	0	ii
Pleurotus ostreatus columbinus	100	30	0	iii

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Step 3: Sawdust Spawn

- Transferred to 3 jars of hydrated/ sterilized alder sawdust
- Currently incubating at 75 degrees F
- Measuring/ recording growth

Species	Jar #1		
Date: August 2, 2016	% growth	density	notes
Coprinus comatus hunter creek	2	ii	mye just by grains
Grifola frondosa	50	ii	
Lentinula edodes	75	ii	
Pleurotus ostreatus brat	100	i-ii	
Pleurotus ostreatus columbinus	80	ii	
Pleurotus wild CA creek	100	i-ii	
Stropharia rugosoannulata	100	i-ii	
Trametes versicolor black	100	ii-iii	mostly iii

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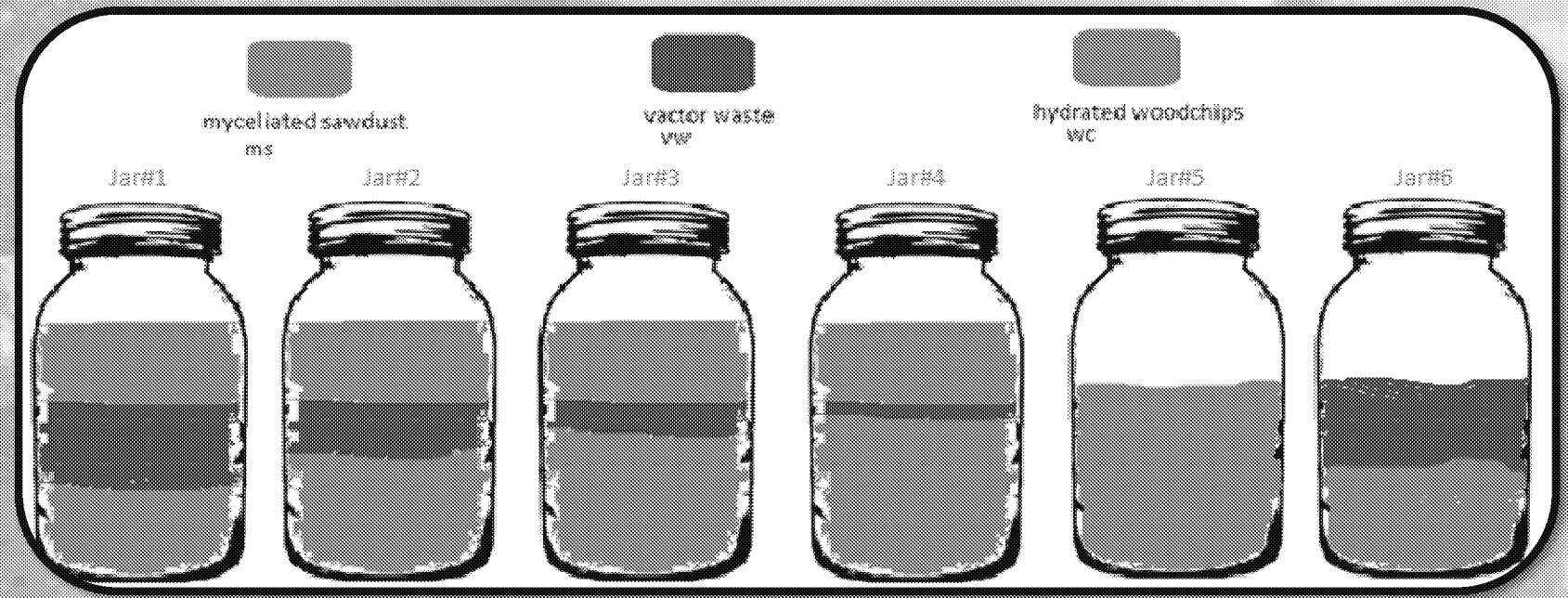
Step 4: Vactor Waste Ratios

For each species:

- Choose best sawdust jars
- Create ratio jars
- Incubate for 8+ weeks
- Observe monitor growth

Ratios:

- Myceliated Sawdust
- Vactor Waste
- Sawdust



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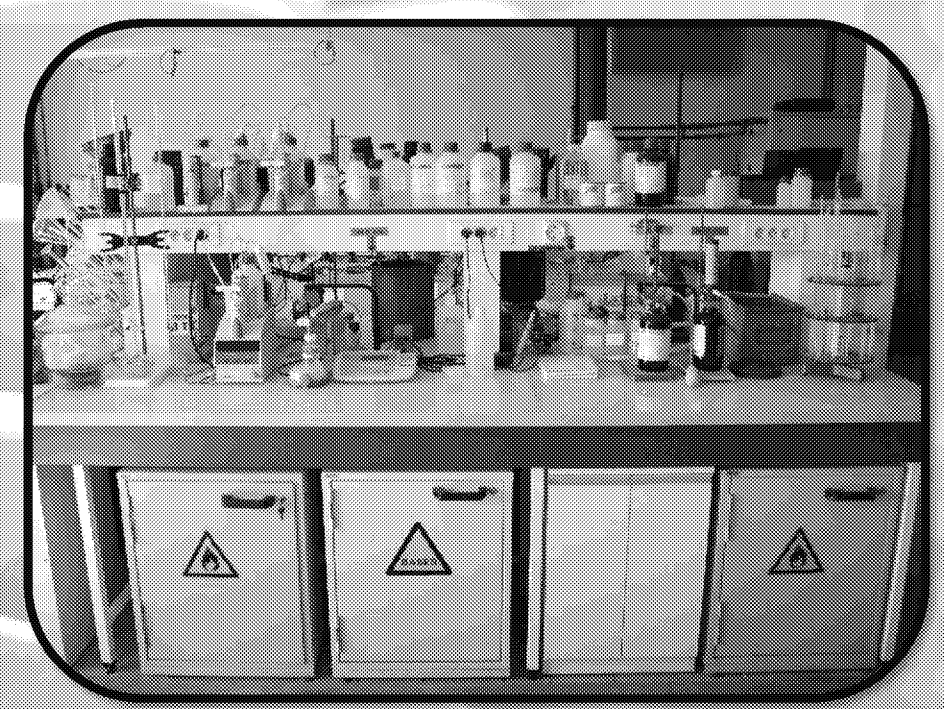
Step 5: Analytical Testing

- Testing before fungal treatment
  - Vactor Waste/ substrate base characterization
  - Still waiting for results

- Testing after fungal treatment
  - Select jars with best growth
  - Send samples for PCB testing
  - Results & Final report



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Mycoremediation Challenges

- Groundbreaking field of biology
- Few similar projects to model after
- Living organisms- respond to environment
- PCB acquisition/ regulations
- Cost of testing

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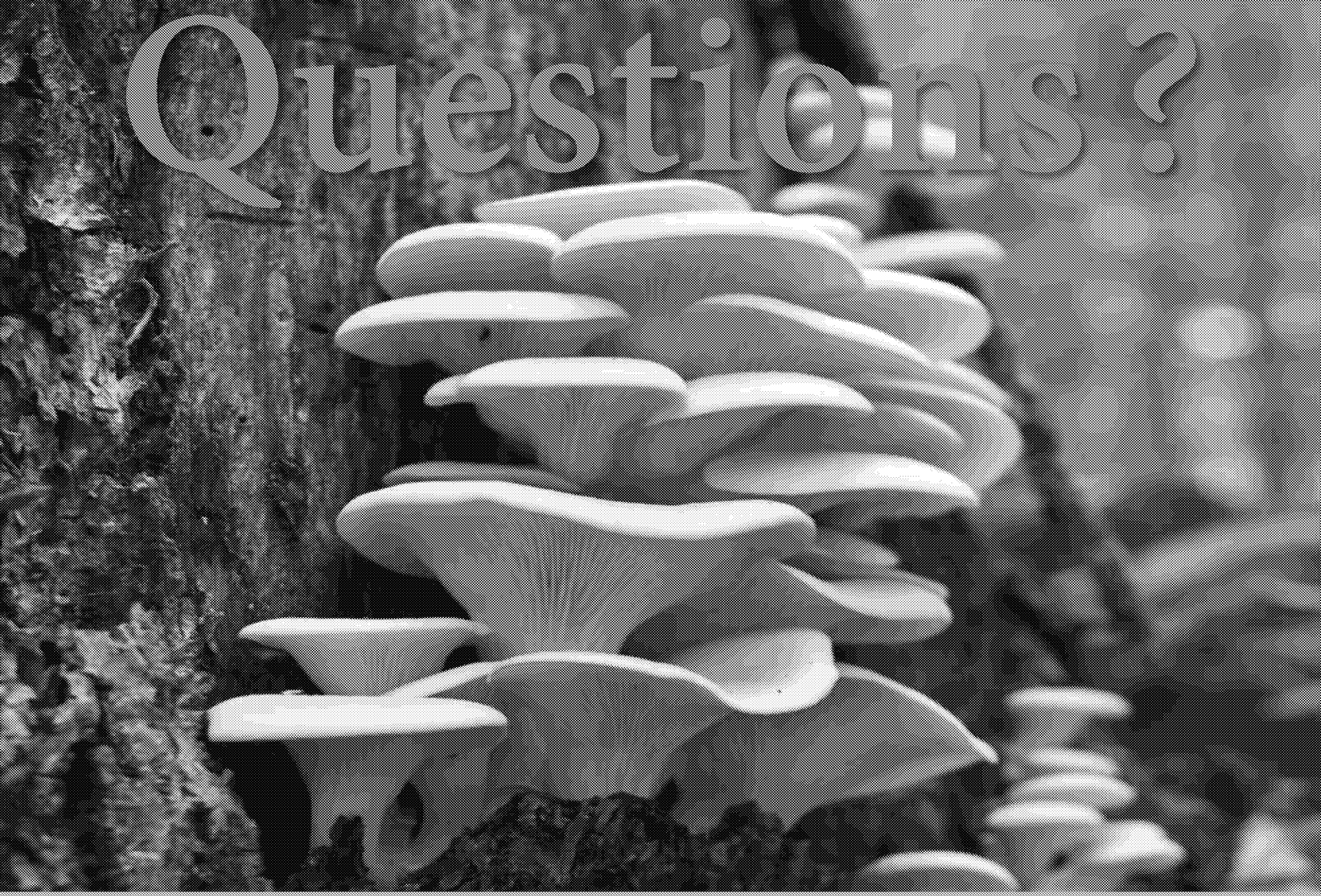
Questions?



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