compos(t)ing…

by

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Abstract

This writing is a window into my mind and the meandering thoughts behind a series of sculptural experiments and installations I have made from compostable materials. The work explores the porosity of bodies as entities and the symbiosis that becomes possible with permeability. Thinking through a critical discourse of ecologies, I (re)imagine and "propose near futures, possible futures, and implausible but real nows" through a materially emergent and ecological, situated practice (Haraway 2016, 136).

I work with the embedded ideas by moving between 3 different lenses. I begin with *Introweaving*, my research as a network of pathways that a worm might meander through in a compost pile, opening the various spaces and materials that I use throughout my experiments. *Bodies as microworlds* probes notions of the body and its porous boundaries; ingesting and regurgitating become critical and generative metaphors for processing ingestible biomaterials made from food refuse. *In/Between* embraces the active process of borrowing and mutating processes and methodologies from distinct spaces and bodies of knowledge. *(Un)Becoming* zooms outwards to the cyclical aspects of life and time – exploring animacy, decay and regeneration as expressive processes.

Complementing the initial *Introweaving* is a final section *Interleaving*, where I pause and gesture towards future experiments. I view this project and thinking as a become-with (ref. symbiosis/ the more-than-human/ land) is an ongoing process. These ideas are need to continuously percolating… my writing and my project are eternally compos(t)ing…

Table of Contents

List of Figures

Acknowledgements

Much of my research and work took place on the unceded land of the xʷməθkʷəy̓əm (Musqueam), Sḵwx̱wú7mesh (Squamish), and səlilwətaɬ (Tsleil-Waututh) Nations. Being here I was able to meet all the people who supported and furthered my praxis and for that I am deeply grateful.

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Prelude

My research and art praxis live in the interstices between disciplines. As an artist driven by curiosity, my process is in conversation with artist-scholar Natalie Loveless' polydisciplinamorous way of research-creation. The spaces I draw from oscillate alongside my research and currently include art, design, material science, culinary, technology, textiles, and ceramics. My work is necessarily emergent, perpetually in a state of becoming-with, and slips through some of the categorizing tendencies of language. Feminist theorist and physicist Karen Barad writes that

> "language has been granted too much power. The linguistic turn, the semiotic turn, the interpretative turn, the cultural turn; it seems that at every turn lately every 'thing' is turned into language or some other form of cultural representation. . . There is an important sense in which the only thing that does not seem to matter anymore is matter" (Barad 2003, 801)

Barad's quote speaks to some of the muddier parts of this thesis support document that attempt to capture aspects of my research praxis that are in motion off the page. This document presents a constellation of my thoughts and processes through metaphors. The headings used are approximations for the multiple themes that have influenced my work thus far. The nature of my work is cyclical and interdependent rather than linear and hierarchical, meaning that the ideas organized under each heading are often modular and fit together in multiple ways. Tracing a constellation means that we are shifting back and forth between the acts of close looking and big picture thinking. Similar to how each star in a constellation can be its own galaxy, the ideas in each section have the complexity to be its own research body. In place of a deep dive, my hope is to draw lines between and around these points to make space for thinking in multiplicities. What possibilities unfold if we are allowed to meander through spaces as a mode of inquiry?

Introweaving as an analogy for how to read this document. Weaving is about interlacing multiple threads to make a whole and we will be pulling specific threads from different artists and thinkers. In our hands, threads can be knitted, crocheted, braided, felted, or plaited together in many ways. I am asking you to be curious with me but weave your own way through for there are multiple ways of making meaning.

> *. . . philosophically and materially, I am a compostist, not a posthumanist. Critters – human and not – become-with each other, compose and decompose each other, in every scale and register of time and stuff in sympoietic tangling, in ecologically evolutionary developmental earthly worlding and unworlding*
>
> —Donna Haraway (Haraway 2016, 97)

Composting as a metaphor

Clammy ridged bodies are squirming. A cloud of winged black dots buzz and hover about. There is a stench that smells like millions of microscopic corpses rotting. Slimy long bodies ooze and excrete moist tunnels as it wriggles. What was once leafy and crisp wilts into a damp flaccid glop; its colours darken to a wet fecal brown. Tentacles glide in their own mucus and the teeth-lined opening of mouths shred the surrounding dead matter. Colonies of bacteria multiply and mutate. Mold spores fuse to form green and white fuzz. In the dark recesses of the soggy mat of rot, pouches of fluid are nursing and thousands of eggs incubating. Larvae feed on the warm lumpy waste. Hundreds of creeping legs crawl through the pile, their antennas twitching for bodies to devour. Organic matter decay into transparent skeletons of veins. Tendrils branch. Roots form. The process repeats with different bodies and new waste.

Introweaving

It is within the ecologies of these maggot-infested food scraps that we will meander together. Like a worm in the compost pile, we will tunnel in and out of bodies and wander through waste. While each space could be its own microworld for inhabiting, we will be worming our way through because a worm's meandering is what brings porosity to newly turned soil. I am working with and through composting as a metaphor, an emergent transdisciplinary process, and an artmaking material.

There is much debate over the naming of our current time[1], yet it is undeniable that the health of our planet is deteriorating. The focus on human societies, needs and perspectives has led to animals, plants and minerals going extinct. Our planet can only sustain the current human way of living for so much longer. In one example, BBC reports that our planet may run out of many rare earth metals, like gallium and indium, within 100 years and yet these metals are necessary components for our medical thermometers, LEDs, solar panels, microchips and even fire sprinkler systems (Gill 2022). It is at the cusp of these near extinctions that my work materially speculates on our planet's potential futures. I create sculptural installations that iteratively respond to the conditions of living symbiotically with animal kin and plant life in the ruin of our planet's current climate condition. This re-imagining situates itself in depleted sites where capitalist extraction has exhausted the land of our current materials and sources of sustenance. My research asks how art can think through composting as a way to reworld with waste.

As an ecologically conscious body living with this planet, my response-ability[2] lies within the fabulations of my practice, accepting feminist theorist Donna Haraway's invitation to "propose near futures, possible futures, and implausible but real nows" to invent a crop of Children of

[1] The term *Anthropocene* is criticized for its human exceptionalist focus on anthropo for "man" in describing our current time. Other interesting terms that I have come across in my research include: Jason Moore's *Capitalocene* characterizing this era as one facing the grips of capitalism; Donna Haraway's *Chthulucene* as a time made of multi-species sympoiesis; Tomas Saraceno's *Aerocene*, an art project seeking to find new modes of ecological sensitivity including imagining a fuel free form of air travel. While I understand that the terminology used to frame the current time makes particular assumptions about the world, I am more interested in the actual ecological health of our planet and do not subscribe to any particular *-cene* in my work.

[2] Haraway writes that response-ability is not only about being responsible for the (hierarchical) relationships we are in but rather to respond in situated ways to how we are entangled in or indebted to multi-species relationships.

Compost in her Camille Stories (Haraway 2016, 136). Haraway's speculative fiction imagines that these Camille children are not human exceptionalist and instead are born for sympoiesis to become-with plant and animal kin alike. While my work does not detail specific political and social structures for these communities of compost like Haraway's stories, my practice iteratively responds to the question of how to live on a damaged planet with capitalist ruins still inhabited by ghosts and by the living.

Bodies as microworlds

Pore-sibilities

Bodies are complex entities with multiple organisms that function sympoietically. My process thinks about bodies as beings, sites, and systems beyond the figurative human or animal body. In the metaphor of composting, bodies are variegated in that a body itself may have bodies within. The porosity of a body cannot be contained by a boundary like a skin. In this sense, my practice is in conversation with queer theorist and philosopher Jasbir Puar:

> "We leave traces of our DNA everywhere we go; we live with other bodies within us, microbes and bacteria, we are enmeshed in forces, affects, energies, we are composites of information. Assemblages do not privilege bodies as human, nor as residing within a human animal/nonhuman animal binary. Along with a de-exceptionalizing of human bodies, multiple forms of matter can be bodies—bodies of water, cities, institutions, and so on. Matter is an actor" (Puar 2012, 56).

My interpretation of Puar's words is that clumps of matter can become bodies or even microworlds because their boundaries become porous at different scales. Considering the complexity of a microbe's internal organization, functions, and system, it can be a body and or a world depending on perspective. The experience from the body of a bacterium is vastly different from a body of soil or a body of water. My research speculates on how we can sense with and through bodies as a way of knowing. In a compost pile, what microworlds would we come to know if we embody the long slimy bodies that meander along rot before entangling with other fungi?

Embodied knowing takes on multiple new meanings when decentered from the human perspective. In conversation with Claire Pentecost's *for the body without organs to sense* (2014), my work *from a detritivore's senses* (2022) (see fig. 1) is an installation that imagines what can be sensed from the bodies of detritivores – the primary composters in many ecosystems. Pentecost's work consists of 31 vintage coal miner's canary cages with human breasts inside molded from pet coke, a petroleum refining by-product (see fig. 2). With a live canary in one of the cages, Pentecost's installation references sensing through the canary's body while *from a detritivore's senses* encourages sensing through detritivores' bodies. My research for sensing with an

arthropod emerged while I was making my first sound piece. Integrating sound was an experiment to bring out the timescales of metaphorically composting materials in my making process. The clips I recorded were sounds from my making process. Process documentation for me was the crunching of eggshells, the grinding of tea leaves or the thickening of xanthan as it coagulated with water. When I was creating my sound collage, I became curious about how worms experience sound and learned that they have no ears. Instead, their moist bodies allow them to sense the vibrations of sound and teach them to survive against predators who may make tapping sounds in their hunt. In response, I composed my sound piece imagining what noises worms would make in their daily lives on a micro level underground. My editing took into consideration the frequency range of 100 to 5000 hertz that worms can perceive in contrast to the 20 to 20 000 hertz humans can hear. The sound is played from a Bluetooth speaker buried inside the dirt. Vibrating through

Fig. 1: Chao, Gwenyth*, from a detritivore's senses*, 2022. Soil from artist's garden, eggshell, green tea, coffee grounds, xanthan gum, bluetooth speaker playing sound piece for worms, dimensions variable. Photo: Jimena Diaz Jirash. Used by permission of the artist.

the soil, the piece's low volume makes it barely perceptible when the viewer initially engages with the work. *from a detritivore's senses* speculates what it's like being inside the body of a detritivore, whether it be a worm or a slug. The eggshell, tea leaves and xanthan gum sculpture has topographic undulations and its structure references the tunnels of underground architecture usually invisible to the human eye. The coffee grounds and tea leaves sculpture wraps into itself and mimics how nests are woven. From the body of a millipede, this work could be a negative cast of the tunnels it bores turned jungle gym.

Fig. 2: Pentecost, Claire, *for the body without organs to sense*, 2014. Coal miner's canary cages, cast petroleum coke, wire, thread, canary, dimensions variable. Installation at Logan Center Gallery. Used by permission of the artist.

Like Pentecost, I am interested in engaging the body as a way to address our consumption in relation to ecological concerns. *for the body without organs to sense* cites the history of using canaries to detect toxic gases in coal mines and suggests that the contemporary equivalent is our reliance on petroleum-based plastics. Instead of the canary's body being sacrificed as an indicator of poison, Pentecost's casting material of pet coke and the form of human breasts propose that the human body is perhaps unable or refusing to sense poison. Pentecost's installation alludes to our consumption of, mostly plastic, materials, while the ingestible biomaterials in *from a detritivore's senses* speak to the physical act of consuming with our bodies. The ability for my eggshell, coffee grounds and tea leaves biomaterials to decompose back to the earth offers an ecologically conscious alternative to Pentecost's broader critique of relying on petroleum and its accompanying environmental consequences. The title *for the body without organs to sense* and the separated/ dismembered breasts convey a sense of disaggregated bodies and are in dialogue with the variegated bodies in *from a detritivore's senses*.

The concept of bodies as permeable entities becomes more uncanny with the fact that less than half our body is composed of human cells; the rest are microscopic colonists like bacteria and fungi (Giraldo Herrera 2018, 72). Bodies permeate bodies, blurring the boundaries of an interior

or exterior. Each body is a world of bodies. My way of thinking through bodies is in dialogue with artist Lotus Laurie Kang's work *Mother* (2019-2020) (see Fig. 4). Kang views the body as an ongoing process and says that "we are porous beings, we are always in a state of becoming in relation to other bodies and the environment around us" (Vankin 2022). To reach beyond the confines of the body is to also grapple with the porosity of other human made perimeters. One of these is the constructed boundary of the plastic compost bin, a box designed to make the messy breakdown of decaying matter orderly. Without the green plastic wall gatekeeping and vetting the contents, bodies and waste intermingle and feed on each other in many ecosystems. Larvae may hatch while bacteria blooms and both can nourish each other. This entangling of bodies is akin to the way I work. Similar to how many processes can unfold simultaneously in a compost pile, I am curious about how multiple modes of being can symbiotically become-with one another. How can bodily functions like ingesting and regurgitating become ways to blur the boundaries of an interior and exterior?

Ingesting with my hands

To ingest is to put materials into the body. I am ingesting food refuse into my body of research through the acts of collecting and processing. To source the food scraps for creating my artmaking materials, I collect vegetable fronds and compostable waste from my home and kitchens in my circle of kin and community. This involves sorting through a gooey pile of organic matter by hand and washing the rotting juices off the materials I collect. While the operation of collecting is for the technical purpose of amassing materials rather than a form of social art practice, there is an underlying ethics of care in my process. My work speaks to political theorist and philosopher Jane Bennett's proposition that eating is perhaps "an encounter between various and variegated bodies" (Bennett 2010, viii). Like eating, collecting materials by hand is akin to an encounter with multiple bodies of plant and earth kin even if the materials are not directly harvested from the land by me. Through my hands, I wonder how I can take in and care for the materials that have been passed to me in accordance with Indigenous botanist Robin Wall Kimmerer's notion of an Honourable Harvest.

Fig. 3: Some of the collected food refuse that will be part of the Gathered Materials Library collection in */stāj/ 2.1* (2021-2023) installation. Photo: Kevin Chao. Used by permission of the artist.

Unlike food materials purchased at a grocery store that operate on a capitalist economy of currency exchange, the Honourable Harvest is characterized by reciprocal relationships where I give back in some way after receiving my materials (Kimmerer 2013, 190). In response to Kimmerer's call for humans to enter into reciprocity with the more-than-human world, I often do not specify the kinds of food refuse I collect (see fig. 3); much of my practice is

committed to (re)valuing the bodies of plant kin as a whole, including the parts that are designated as organic waste. I believe that reciprocity asks us to rethink hierarchical relationships including human exceptionalist notions of control over the land. As such, my material exploration broadly accepts food refuse from the meals that my community and I recently ate. While I recognize that these are partly influenced by what was on sale in the grocery store, my focus is on materials that respond to the local growing season and ultimately the weather and climate in the region. For example, it is not unusual for me to work with kale stems that are in season or to collect cherry blossom petals following their bloom in Vancouver. I work with the variety and quantity I can collect because I am less interested in creating art materials out of specific foods and more concerned with the possibilities that emerge from revaluing what is considered organic waste.

Fig. 4: Kang, Lotus Laurie, *Mother*, 2019-2020. Stainless steel mixing bowls, pigmented silicone, rubber, polymer clay, power mesh, paint can, cordyceps fungus, steel machinery, peach pit, lotus seed, pewter, cast aluminum ginseng, cast aluminum cabbage, cast aluminum peach pit, cast aluminum lotus root, cast aluminum Asian pears, cast aluminum anchovies, cast aluminum clay forms, aluminum mesh, sand bag, plastic wrap, copper chainmail made by Hanna Hur, reflective foil, plastic bags, copper garden mesh, slippers, dried mung beans, dried fish bladder, dried magnolia flowers, dried hibiscus, ground mung and adzuki beans, cast bronze, hats, dimensions variable. Installation at Helena Anrather. Used by permission of the artist.

My material considerations are in conversation with Lotus Laurie Kang's installation *Mother* (2019-2020) (see fig. 4) where Kang arranges forty-one stainless steels bowls with a variety of materials from aluminum casts of Asian pears to dried hibiscus. Kang and I both use food and tools from culinary spaces to reference these contents' intimate relationship to the body. Whereas Kang's work sometimes cites Asian medicine and mostly includes foods familiar to her upbringing, the references and foods that appear in my

work do not have a specific cultural designation. Kang alludes to the body's interaction with food through the formal aesthetics of her work. She primarily employs food as a signifier or metaphor; even the real food materials in *Mother* don't truly function as food anymore because they are suspended in polymer agents like resin and silicone that freeze the natural processes of rot and decay. Conversely, I specifically work with food as a material because of its perishable nature. Like the leafy greens that wilt and break down in a compost pile, I am interested in how the act of perishing can be an emergent process.

Ingesting with my hands allows me to confuse the value systems embedded in different knowledge bodies. The same food materials can have different values and functions depending on the framing apparatus used. In the culinary world, eggshells are generally not consumed and designated as organic waste, yet nutritionally eggshells can be crushed and used by the human body as a protein supplement. Even within the same culinary world, coffee grounds get thrown out after brewing yet delicacies like chocolate covered coffee beans exist in desserts found in the world of fine dining. In the mess of the compost pile, the discipline-specific designations of value dissolve as bodies ingest each other in a process of entangling. Thinking through Bennett's proposition that eating is an encounter with other bodies, I intentionally create ingestible artmaking materials to play on how ingestibility and edibility produce different, sometimes conflicting, values in relation to bodies.

Regurgitating as a process

Regurgitation tends to have a negative connotation because it implies that whatever comes back out of the body, usually the mouth, has no value. For example, to regurgitate information is to repeat memorized content without critical thinking or reflection. This use of regurgitation assumes that the contents expelled are the same as the contents consumed. Yet when a body physically regurgitates food, it expels half-digested bites that have broken down and mixed with mucus, acids, and saliva. Interestingly, literal regurgitated matter is also considered to have no value because it has been mixed with other substances; meanwhile figuratively regurgitated content is considered to have no value because it remains identical to the consumed material. Working with this contradiction, I wonder how regurgitation as an operation can challenge the idea that expelled matter is waste. How can the organic materials I work with be more than waste?

Human bodies regurgitate to expel harmful substances that may irritate or upset the stomach. Meanwhile, animal kin often regurgitate voluntarily as a means to store their prey and feed their young. I borrow from the process of regurgitation in both these ways. The raw materials I collect are considered organic waste. Diving deeper into this designation, I question how much of the contents in green bins are really compostable. Notwithstanding the contents that are missorted or contaminated, some of our food waste inevitably have non-compostable humanmade materials considering that microplastics have leached into the waterways and farmlands used for growing food (Lofty et al. 2022). In the metaphor of ingesting and regurgitating these materials with my hands, I am perhaps trying to store them in artwork like trees sequestering carbon. My making process is like the messy abject process of literal regurgitation in bodies. Food refuse as a material has the potential to reflect the transmutational relationships it has with the body; what we put into bodies as food gets regurgitated and becomes transformed when expelled.

In the process of making my artmaking materials, I work with the material's inherent properties when deciding whether it will be a gel, putty, clay, or paper substrate. For example, beets naturally do not have enough cellulose fibers to be made into paper using my processing technique. While it is possible to refine beet pulp and improve fiber quality through acidic hydrolysis in a lab (Hassan et al. 2021), I am more interested in working with the beets to transform

them into a biocomposite with a stronger food binder. To process materials for gels, putties and clays, the general procedure is to dry, grind, sift and bind. Often it is the food binder and water content that determine the texture and viscosity differences that make a material a gel, putty, or clay. First, I dry the collected materials over the course of 1 to 7 days depending on how much moisture is in the food refuse. In addition to the size and shape of the food bits, certain materials will mold before air drying through to the core and need to be put in a dehydrator. The dried materials are then ground up using coffee and spice grinders. If the drying process wasn't thorough and moisture is left over, the material will clump in the grinding process and become coarse. The powder then gets sifted through multiple strainers with different mesh counts varying from coarse to fine particles. The size of the powder effects how the final material can be used. Finer particles allow for the material to be extruded through smaller openings and creates thin lines while coarser particles make the materials easier to combine by reducing the chances of clumping. The final binding process greatly influences its output. Xanthan gum (commonly used in chewing gum) generally hardens to give the material strength while methylcellulose (a gelling agent that prevents the formation of ice crystals used in ice cream) makes a material more malleable. Gelatin is thermoreversible and can be reworked with heat even after solidifying, while glycerin is used to make a material flexible and soft because of its hygroscopic properties as a humectant. In my process, I experiment with many other different food binders and varying ratios of ingredients out of curiosity for what each material can do. To record my material exploration, each component of the recipe is weighed out on a scale and mixed with a magnetic stirrer at consistent speeds and temperatures.

Beyond gels, putties, and clays, I save materials with properties that are more fibrous, like celery veins, to make paper substrates. My material research into vegetable paper making began at Vermont Studio Center in the summer of 2022. Since the artist residency wasn't equipped with papermaking facilities and specialized equipment like a Hollander beater, I experimented with processing vegetable fibers through cooking methods. Especially tough fibers like kale stems were softened by boiling, tenderizing, or blending. With my makeshift papermaking set up, I became familiar with how the vegetable fibers and paper pulp mixtures needed to feel by hand. Many of the plant paper recipes I researched required additives like bleach and binders to whiten and

strengthen the paper. Working with the self-imposed parameter of ingestible materials, I experimented with different ways to make paper with just vegetable fronds and water. I researched the qualities of cellulose fibers in soft and hard woods and worked backwards to find comparable vegetable cellulose fibers.

Fig. 5: Some of the biomaterial parts that will be part of the Transmuted Materials Library collection in the */stāj/ 2.1* (2021-2023) installation. Photo courtesy of the artist.

I was thinking about how paper could become part of the array of biomaterials I use to build sculptures (see fig. 5) and wasn't interested in creating archival or smooth paper. This gave me permission to play and intentionally make paper the wrong way. For example, I don't rinse out my pulp because I was curious about the colour and sliminess that was in the water from this pulping process. I found that including the used water gave the paper a bit more of the vegetable's original colour and sometimes the slime would help the fibers bond together despite the rancid smell that polluted my studio during the drying period. In the process of making paper all wrong, the sheets would fold and crumple into itself while drying because I chose not to press or flatten them. This discovery led me to explore ways to cast with paper to create 3D forms. Trialing multiple fabrics and molds for easy release, I experimented with combining paper mâché techniques and wet felting methods to create 3D forms without specialized equipment. My current process includes heavyweight interfacing fabric and molds made of water absorbing materials like plaster or stone.

The experimental processes for my biomaterials are often time-consuming since it isn't uncommon for materials to cure from 1 to 5 days before testing. Throughout my research, I feel that I am co-experimenting with others because of the accessibility of open-source information on biomaterials – such as materiom.org, an online database of biomaterial recipes with contributions by material scientists, designers, and artists like myself (see Appendix I for the recipes I've contributed).

My form of regurgitation is collecting materials that have already been consumed and transmuting them into another form. Perhaps this material reconstitution parallels the regurgitation cycle that happens to bodies in a compost pile. Worms are said to ingest bits of soil along with food scraps and regurgitate casings of nutrient rich amendments. Unlike the human-centric understanding of regurgitation, bodies in a compost pile ingest what we deem as waste and regurgitate nutrients that restore the soil body. Rather than being an operation that generates waste, could regurgitation be a process for us to know more intimately what we have consumed and the other lives a material can have?

In/Between

Smuggling as a mode of being

The green plastic wall is impenetrable for the bodies and organisms that are trapped on the in/outside. I resonate with these creatures in that I also encounter walls working in-between disciplines. When trying to bring together tools and techniques, I am made aware of the tendency for Western knowledge systems to prioritize difference; disciplines and knowledge spheres are focused on distinguishing their practices from each other. Taxonomy prescribes precise nomenclature for recording knowledge, specialized tools for making and even specific design expectations for physical spaces. In many ways, the design of spaces – from kitchen workstations to science labs – designates specific outputs. I wonder if perhaps these constructed boundaries are like the green plastic wall of our compost bins when the world is actually more like the unvetted composting piles in many ecosystems. What could emerge from a porous transdisciplinary research space?

/stāj/ (2021-) is a pop-up space that houses the growing libraries in my research praxis, inviting viewers to browse and borrow ideas and or methods. This ongoing project is a series of continuously evolving site-responsive spaces that reflect the current interests in my research praxis at the time of installation. */stāj/* is the phonetic spelling of the word stage, which originates from the French word stagiaire, loosely translated to mean apprentice or intern. In the culinary world today, a stage is a trial period where a new cook works in another chef's kitchen. Stages are typically unpaid and were originally opportunities for newcomers to train and learn how to become a chef before the advent of modern culinary schools. Today stages are more often used to assess whether a newcomer can adjust and respond to the workings of the head chef's kitchen before they are given an official (paid) position. By titling my work */stāj/* I am positioning myself with a stagiaire, a newcomer akin to Claire Pentecost's paradigm of a Public Amateur – an artist who can be a conduit between specialized fields because they can approach and question the object of knowledge with curiosity rather than the expectation of being a subject matter expert (Pentecost 2008, 39). In my installation, I am trialing my transdisciplinary space of research and

making with the physical and systematic architecture of conventional making spaces like studios, kitchens, and labs.

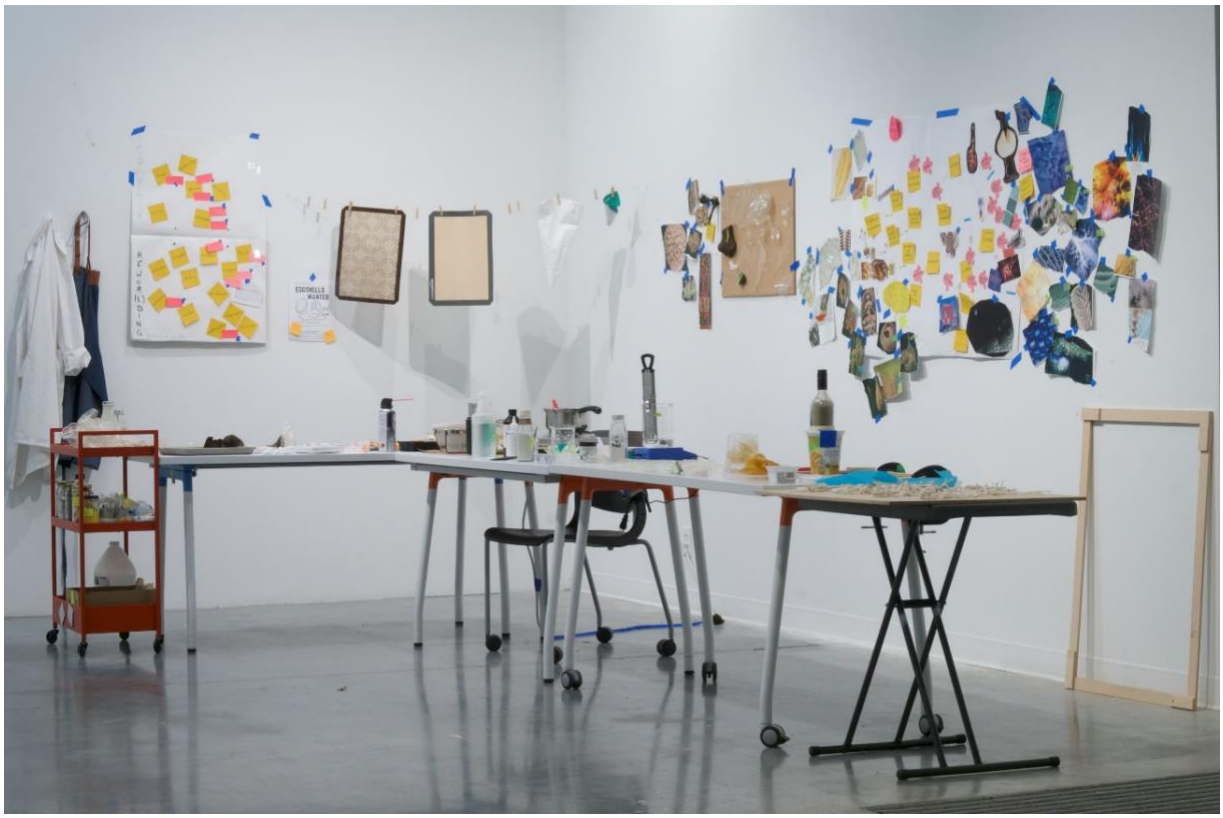

Fig. 6: Chao, Gwenyth, */stāj/ 1.0* (installation view), 2021-. Mixed media installation of a lab-kitchen-studio research space, dimensions variable. This first iteration of */stāj/* was installed at Emily Carr University of Art + Design in 2021. Photo courtesy of the artist.

In my experience, transdisciplinary research and making spaces like */stāj/* are not commonplace. This means I am often working around established systems and structures. As such, many aspects of my artmaking are in dialogue with UK-based curator Irit Rogoff's writing on smuggling as a curatorial practice. On a surface level, smuggling usually involves some form of disguise. My playing with food stems from me initially trying to disguise my disinterest in making and eating food. In my circle of kin, the bodies that my body is around, there are pastry chefs, cooks, culinary tourists, and foragers – all intimately connected to food. My partner is a passionate home cook who finds it fun to make pasta from scratch, bake fresh bread, and curdle cheese. My best friend will tap her own maple tree, make her own vinaigrettes, and brew her own beer. The experience of making and eating food together is their raison d'être.

Moving between the culinary and art worlds became a catalyst for me to continue traversing between other knowledge bodies. Rogoff writes that smuggling is "a form of

surreptitious transfer, of clandestine transfer from one realm into another. The passage of contraband from here to there is not sanctioned and does not have visible and available protocols to follow. Its workings embody a state of precariousness which is characteristic of many facets of our current lives" (Rogoff 2006, 4). It is from this position and understanding of multiplicities that my transdisciplinary practice operates. While all artists draw inspiration (often for subjects or content) from many places, I am specifically interested in smuggling processes of thinking and making from other spaces into my art practice.

Smuggling is a mode of being that traces existing boundaries; it is not about redrawing divisions but more focused on making space along these passages for others to inhabit. My areas of research oscillate (see fig. 7) and currently include but is not limited to: watching how-to videos of gastronomy cooking to learn the spherification process of making caviar, reading scientific papers on how edible food packaging can be made, understanding how ceramicists use coil building techniques to create form, interviewing cake decorators on piping with differently shaped cake tips, or visiting the labs of material scientists making nano paper.

My innate curiosity makes me wonder how I can adapt these discipline-specific techniques and ways of thinking to work with

Fig.7: (from top clockwise) Some of the transdisciplinary processes adopted in my work: gastronomy spherification, ceramic coil building, textile weaving, food science, polymer chemistry, pastry decorating, 3D printing, industrial design prototyping. Photo courtesy of the artist.

biomaterials. For me, active experimentation often means using equipment that is unavailable at a traditional art store, ranging from medical syringes, magnetic stirrers, cupcake injectors to glue gun mats and specialized tweezers. Most of my smuggled tools are retrofitted or intentionally misused, effectively muddling the apparatus' original function. My aftermarket MacGyvering is similar to how the operation of smuggling neither directly conflicts with nor critiques the dominant paradigms.

How can thinking in this interstitial space allow for alternative ways of being to exist beyond the expectation for meaning to be singular? Often times, positioning work with conjunctives like 'art and science,' 'art and design', 'art and craft' or 'art and food' become shortcuts to make meaning. Yet perhaps accepting the dissonance and contradictions that come with multiplicities is one way to subvert the notion that "meaning is immanent, that it is always already there and precedes its uncovering" (Rogoff 2006, 1). My process thinks in dialogue with Rogoff's argument that "in a reflective shift, from the analytical to the performative function of observation and of participation, we can agree that meaning is not excavated for, but rather, that it takes place in the present" (Rogoff 2006, 2). Through my work, I am inviting viewers to meander with me in my process so that we can be present to its unfolding together. We all bring with us particular apparatuses that frame how we engage with the world; I am curious how being within the space of smuggling can disrupt or jam its regular function. Since smuggling is unsanctioned, its subjects, objects and practices all operate outside of a prescribed framework. How can viewers attune to the internal incoherences of smuggling boundlessly and allow their apparatus to kaleidoscope?

Smuggling creates space within its passages, making it possible for the act of meandering to be a collaborative albeit asynchronous operation. Bodies can trace along the boundaries that others have smuggled through. Bodies can even inhabit within these spaces of smuggling. In a compost pile, change is only possible through the smuggling of new bodies and the tunneling of space within these passages. Without the movement of unvetted bodies and materials, a compost pile would not have the biodiverse ecologies it needs to survive.

(Un)Becoming

Animacy

There are figurative and literal notions of animacy in my work and I am curious about this aliveness on a micro level because these forces are present in my materials. To destabilize our human perception in artmaking, my process is to think with the other forces and beings that collaborate with me in my making. Animacy itself has multiple interpretations. Political theorist and philosopher Jane Bennett calls it vitality and defines it as "the capacity of things - edibles, commodities, storms, metals - not only to impede or block the will and designs of humans but also to act as quasi agents or forces with trajectories, propensities, or tendencies of their own" (Bennett 2010, viii). Feminist theorist and physicist Karen Barad's writings argue that matter itself has a degree of performative metaphysics and that there exist everywhere relationships of intra-action[3] regardless of whether it is observable by the human eye. Working with these two definitions, I am thinking through notions of animate forces in relation to bodies.

The conventional Western understanding of bodies is that they are fixed entities. Giraldo Herrera explains that we tend to think bodies are stable scientifically because of how we relate the replication and inheritance of DNA with identity (Giraldo Herrera 2018, 72). Yet perhaps it is more accurate to say that "bodies are unstable entities that cannot be seamlessly disaggregated into identity formations" (Puar 2012, 56). Microbially, 98% of a human body's working DNA is highly autonomous bacterial microorganisms that act on their own self-interests (Giraldo Herrera 2018, 73). Microbial activity, especially those in the brain and the gut, affects the host's behaviour and literally transforms their bodies (Giraldo Herrera 2018, 74). Microbes can act and respond to any given environment because microbial communication involves a horizontal transfer of genes between the same species (Giraldo Herrera 2018, 72). The microbial activity in my biomaterials is literally a form of collaborative animacy. In the studio when I am concocting with my biomaterials, I sense that each of my raw materials have a vitality and internal intelligence that influence how they want to organize themselves. Disrupting the colonial and

[3] Karen Barad writes that intra-action, unlike interaction, does not assume that separate independence of entities exists and acts on their own. It is through intra-action that differentiations emerge and individuals and their ability to act materialize within the relationship.

extractive legacy of subjugating materials under an artist's hand, I am intentionally negotiating contingencies by sharing the making process with living organic materials. Rather than forcing specific forms on to my materials, I work with its desire to shrink, roll, peel, or fray as part of my making process.

In my assemblages, I am combining multiple biomaterials to experiment with how they live and become with each other. The sense of animacy in *Magnoliigastropoda* (2022) among others in my *symbionts of capitalist ruin* series (2022-) gesture to a degree of agency within the work. Like many of my own sculptures in this series, *Magnoliigastropoda* (see fig. 8) will incrementally soften or stiffen and shift ever so slightly in form at different temperature and humidity levels. The static aliveness within my work challenges the idea that animacy is dependent on the capacity to move or act; if something cannot move, then it must be inanimate (Grosz 2011, 69). The caveat that debunks this understanding of animacy is that time itself is a multiple and fluctuating phenomenon that operates on many scales, many of which are outside

Fig.8: Chao, Gwenyth, *Heterobranchicarida,* 2022. Ingestible biomaterial made from onion skin, coffee grounds, mizuna flowers, tea leaves, eggshell, purple cabbage stem, gelatin, xanthan gum (fermented sugar), sodium alginate (seaweed), methylcellulose (vegetable cellulose), 3" x 6" x 4". Photo: Michael Love. Used by permission of the artist.

a human's lifespan, perception, or experience. Humans cannot see the earth or its continents move with the naked eye. In addition to our reliance on seeing as an input for knowing, the ways that animacy is communicated, and thus understood, is limited in the English language.

According to Indigenous botanist Robin Wall Kimmerer, the noun-based language of English limits the possibilities for animacy because 'it' is used to refer to most non-human entities and enforces a dichotomy between human and thing (Kimmerer 2013, 57). By comparison, 'it' is only used for human-made things in the Anishinaabe language of Potawatomi because the words used to address family are also used for the living world (Kimmerer 2013, 55). Like many other Indigenous languages, the verb-based nature of Potawatomi means that many words that are nouns in English become verbs in Potawatomi; 'bay' becomes 'to be a bay' (Kimmerer 2013, 55). I am interested in this sense of animacy in my making process and sculptures; in work that is always in a state of be(com)ing.

Kimmerer also noticed that the language of science is one of distance in that Latin binomial nomenclature deadens its subject (Kimmerer 2013, 49). My concern with scientific naming conventions is that this supposed objectivity and system of classification is laced with colonial interests and embedded value systems. Plants, animals, people's skills, and knowledge, even rocks, are subject to a system favouring classification and, as a result, some form of hierarchy. Queer theorist Mel Y. Chen deconstructs that "animacy hierarchies are precisely about which things can or cannot affect—or be affected by—which other things within a specific scheme of possible action" (Chen 2012, 30). The act of classification can essentially be used to determine whether a material is animate and alive or inert and not sentient.

In dialogue with Kimmerer and Chen, the titles of my sculptures in the series *symbionts of capitalist ruin* are made up Latin scientific names that intentionally confuse the designated genera and its accompanying understanding of animacy. My made-up titles play on the arbitrary and sometimes conflicting categories that occur in authentic binomial nomenclature. *Biovalvia echinodermomycete* (2022) (see fig. 9) is one of my hybrid plant-animal-rock-marine species. In speculating about the symbiosis between different variegated bodies in a post-capitalist world, I'm proposing that what science deems as inert are perhaps animate bodies with forces that shape more of our surrounding environments and our own bodies than we think. My

Fig.9: Chao, Gwenyth, *Biovalvia echinodermomycete,* 2022. Ingestible biomaterial made from onion skin, green bean husk, tea leaves, kiwi skin, garlic peel, eggshell, purple cabbage stem, gelatin, xanthan gum (fermented sugar), sodium alginate (seaweed), methylcellulose (vegetable cellulose), 9" x 5.5" x 4". Photo: Michael Love. Used by permission of the artist.

(re)imagined beings are in conversation with artist and designer Pinar Yoldas' exhibition *An Ecosystem of Excess* where she speculates on a post-anthropocene ecosystem. Her works *E-Plasticeptor* (2014)*, P-Plastoceptor* (2014)*, Stomaximus* (2014) (see fig. 10) propose that the sensory organs of future species will be able to sense and metabolize plastic. Yoldas and I are both imagining that the bodies that will emerge in a near future will differ from the ones we know today. While her work considers the extinction of existing species in her reimagined bodies, my sculptures focus on the endless possibilities for different bodies to become-with one another in ecologies of capitalist ruin. Yoldas' exhibition design intentionally frames the bodies in her work as inert and inanimate; she specially designed pedestals to display the skeletal-like remains in some sort of preserving fluid. Meanwhile, I am more curious about the animate possibilities for my sculptures in the *symbionts of capitalist ruin* series.

Paralleling the biomaterials' micro-aliveness that I work with in my making process, I am interested in allowing the work to occupy its installation site to some degree. The sculptures appear to be alive and can move when we are not looking. My process for creating these sculptural assemblages takes into consideration the possibilities for the organization of parts to create meaning. Thinking through the notion of symbiosis, how can bringing multiple materials together create relations that give rise to concepts like animacy? Perhaps it is by creating dynamic assemblages that we are able to model a perpetual becoming and animacy. These very forces sustain the cycle of composting and in the messy mix of a compost pile, classification systems that seek to name, divide, and control our environments fall to the wayside. Alternatively, the bodies and ecologies that can thrive and meander on a damaged planet are perhaps necessarily animate and in constant intra-action.

Fig. 10: Yoldas, Pinar, *E-Plasticeptor, P-Plastoceptor, Stomaximus,* 2014, from the *An Ecosystem of Excess* exhibition. Polymer clay, resin, special design pedestals, dimensions variable. Installation at Ernst Schering Foundation. Used by permission of the artist.

(In)forming

The experimental and process-based nature of my practice means that the forms of my work emerge through material explorations. I do not begin with a sketch or visual image for what I make because I am interested in the possibilities for materials to speak and exist. My experimentation process allows me to know materials more intimately and to better understand the potential for different biomaterials. I am driven by interchangeable versions of the question: how would this _____ making/ thinking process interact with this _____ biomaterial? I find it difficult to think and make with specific forms; my considerations for form revolve around what it means to be plastic. Seldom is the material of plastic subject to the question of specific forms because its versatility allows it to take on almost any form. I am interested in being plastic with my biomaterials; I believe that with research and experimentation it is possible for biomaterials to be just as versatile and response-ive.

The organic forms of my sculptures are sometimes read as creatures, dwellings, or some sort of fossilized remains. My interpretation of these forms is a symbiotic becoming-with of body, habitat, and food. *Heterobranchicarida* (2022) (see fig. 11) is one of the sculptures from my series

Fig. 11: Chao, Gwenyth, *Heterobranchicarida*, 2022. Ingestible biomaterial made from onion skin, coffee grounds, mizuna flowers, tea leaves, eggshell, purple cabbage stem, gelatin, xanthan gum (fermented sugar), sodium alginate (seaweed), methylcellulose (vegetable cellulose), 3” x 6” x 4”. Photo: Michael Love. Used by permission of the artist.

symbionts of capitalist ruin (2022-) that is simultaneously a body of a being, a refuge, and a food source. Rather than distinguish between these categories, I am curious how this hybridized form is closer to the forms of life in many of our ecosystems. One example of this symbiosis is in the behaviour of entomopathogenic fungi. Certain fungi will enter the bodies of specific insects and inhabit their bodies while converting the insect's tissues into nutrients (Fernandes et al. 2012, 828). *Heterobranchicarida* and the Western tarnish plant bug (see fig. 12) share more similarities than expected considering I came across this image of the bug after creating the sculpture. Unsurprisingly, the forms in my work are inspired by the organic geometry found in animal, plant, and earth kin. I study different patterns ranging from the shapes of coral formation, the layers of rock sedimentation to the rhizomes of root systems. Beyond being visual references for aesthetic form, these patterns become ways for me to physically assemble and build my assemblages. I am fascinated by these fractals because their patterns repeat organically without uniformity. While the repetition in fractals may be a simple process, they are complex systems that are infinitely self-similar but not identical. I am curious how thinking and working iteratively through multiplicities echo the nuances of repeating fractal patterns.

Fig. 12: Dara, Surendra, *Western tarnish plant bug (Lygus hesperus) killed by the entomopathogenic fungus, Beauveria bassiana,* 2014. Photo: Surendra Dara. © 2014 Regents of the University of California. Used by permission.

While fractals can be made of lines, a straight line is not mathematically considered a fractal. When thinking with my hands, I often extrude or pipe my biomaterials into lines and these lines can be layered to build form. Through this repetitive process, I have been thinking more deeply about what it means to draw lines (of relations). Lines need not become shapes that close us in nor perfect symmetrical geometry. Since I do not begin my process with specific forms, the lines I extrude are more concerned with creating, rather than containing, space. Paul Klee understood lines as a dot that went on a walk, and this meandering reflects many of the processes in both my art practice and the nature of my research, arriving at some way of knowing. Lines are

Fig.13: Chao, Gwenyth, a*podeme of a line,* 2022-. Ingestible biomaterial made from purple cabbage, orange peels, mizuna flowers, onion skins, cherry blossom petals, methylcellulose, dimensions variable. Photo courtesy of the artist.

often conflated with being linear, moving from point A to point B, or with logic, as in a linear function in mathematics. This obsession with a straight(forward) line is perhaps the simplest and most reduced understanding of only one segment of a longer line that has the potential to curve and zigzag like a rhizomatic doodle. My interest in the nuanced possibilities for line are in conversation with Belgian curator Catherine De Zegher's writing on setting line free (Butler and De Zegher, 2011).

In my site-responsive installation, *apodeme of a line* (2022-) (see fig. 13) I am thinking about how lines can create space when they are given space to freely meander. To install the work, I find existing holes in the architecture for the lines to latch on to rather than nailing the lines to the wall. How can my lines latch on to the holes left by an imperfectly cast cement pillar or a crack in the wooden framing? Without any fasteners to hold the installation in place, the work shows the strength of biomaterials to hold itself up. *apodeme of a line* is an ongoing project that creates networks in response to the architecture of its site. I am interested in how freed lines can physically and figuratively draw relations and create connections. *apodeme of a line* is in conversation with artist Tomas Saraceno's installation *Free the Air: How to hear the universe is a spider/web* (2022) that I experienced in New York in the summer of 2022. As a 95-foot-wide installation made of wire netting that mimics spider webs, I balanced myself on these lines that physically connected me with the other viewers. The experience of laying down on the wire netting and feeling the vibrations of spiders through shaking speakers stayed with me. *Free the Air* was my first experience of embodied knowing and its more-than-human sensing also speaks to the themes in *from a detritivore's senses.* While *apodeme of a line* inhabits an existing space and *Free the Air* creates its own architecture, both works use lines to underline the relationship between humans and their environments. Line becomes an important metaphor for thinking about form and the processes of forming. In a compost pile, the meandering of a worm is a process for turning soil, yet it also makes a squiggly line. I am interested in the possibilities for process to continually inform form. Like the compost pile that is a heap always in processes of forming, how can work be similarly (in)forming?

Decaying and regenerating

Composting is messy and slow. Even at its most "efficient" timescale, where conditions are near ideal and organic matter is strictly vetted, a well-managed compost pile will take the lifetime of a dragonfly or approximately 4 months (Hu 2020). More commonly, compost piles have unshredded and unvetted material and this will take the lifetime of a worker termite, or approximately a year or two, to decompose matter. These timelines are estimates at best and wild guesses at worst because each compost pile is different. The bodies and matter in the pile create a unique mix which in turn affects the ratio of dry and wet material, availability of oxygen, moisture levels, temperature, and PH. Regardless of these factors that influence the pile's timeline, there is no composting without decomposition. It is a necessity for leaves to dissolve into skeletal veins and bodies to become fertile feasting grounds for other bodies. Similarly, my making process considers the breakdown of my materials.

Creating with art materials that are ingestible means I am also working with their eventual return back to organic matter. I think about the possibilities of being in cyclical, rather than linear, time and the activities of decay and regeneration that can be part of my process. I am curious about the potential for unstable organic materials like mine to subvert the tendency for preservation and its colonial history in Western cultural institutions. Rather than freezing something for eternity, how can inherent processes of breakage and degradation become part of the experience? In the *symbionts of capitalist ruin* series, I am thinking about ways to embody the continual decay and regeneration that exist in cyclical time. In a compost pile, bodies experience wear, tear, and renewal in their (un)becoming. Similarly, the bodies of my sculptures become chipped or dismembered as they move through the world. This breakage is sometimes human-related and sometimes a reflection of the material's instability. Biomaterials inherently have microorganisms within them, and their enzymatic activity or the material's reaction to its environment can lead to biodeterioration or biofragmentation. Both these processes microscopically weaken the material's structure over time until it becomes dust.

Like how decayed rot becomes material for new growth in the figuration of compost, my process is regenerated every time I return to the studio. As my research on biomaterials enters its two-year mark, I have collected enough body parts from my sculptures to create my own

economy of reuse. On a material level, dismembered pieces become part of new bodies while broken-down bodies fuse with other bodies. Conceptually, ideas get deconstructed and then reconstituted. Both continuously become-with one another.

While this cycle is not how we commonly think about (art) objects in a human timescale, it is perhaps a more accurate reflection of the growing and decaying activities that take place on our planet both micro and macroscopically. One example is this cycle's similarity to how filaments on fungi grow. For a filament to lengthen and branch out, it must first break its outer membrane at its weakest point: the tip. In this breakage, proteins and other enzymes float out to the exterior of the filament where it gets reabsorbed and forms a new section (Steinberg et al. 2017). If there is no breakage, the fungi filaments cannot regenerate in greater lengths. Likewise in my process, breakdown also leads to some sort of evolved form and *Eubrachyuroida echinopsida* (2022) (see fig. 14) is one regeneration of a previously incomplete body that broke and fell.

Fig. 14: (left to right) A view of the previously broken body and the regenerated form. Chao, Gwenyth, *Eubrachyuroida echinopsida*, 2022. Ingestible biomaterial made from garlic, purple cabbage, tea leaves, gelatin, and xanthan gum (fermented sugar), 8" x 4.5" x 4". Photo courtesy of the artist.

Unlike regeneration, decay tends to be negatively associated with processes of breakdown that are undesirable. Processes like rot and mold are seen as precursors to becoming waste; any signs of rot or mold immediately undercut a material's value in a capitalist society. Yet in the compost pile, the moldy sludge and rotting corpses that turn us away also create the necessary conditions for new life. In my most recent explorations, I am experimenting with how my sculptures can lean into this abject[4] process considering that it is integral to the cycle of decay and regeneration. *Avialamycotagracileria* (2022) (see fig. 15) is an ongoing experiment for me to observe how fungi, whether it be mold or mycelium, inhabit and colonize the biomaterials in my sculptures. As a regeneration, *Avialamycotagracileria* fuses a previous body with other

[4] Julia Kristeva writes that the abject is a human reaction of horror/ disgust that occurs when the subject and object fuse together and threaten a breakdown of meaning because this merge traumatically reminds us of our own (corporeal) materiality.

dismembered parts with fungi. Thus far, mold and mycelium are competing to becoming-with *Avialamycotagracileria* as it materially breaks down. I am curious how this microworld parallels the decomposition of bodies on bodies in the compost pile. Thinking through the metaphor of composting, how can the processes of breakdown or degradation, commonly associated with waste, be reframed as essential to be(com)ing?

Fig. 15: (left to right) A view of the previously body and the regenerated fungi fused form. Chao, Gwenyth, *Avialamycotagracileria*, 2022. Ingestible biomaterial made from green bean husks, lettuce, cherry blossom petals, tea leaves, eggshell, gelatin, and xanthan gum (fermented sugar), 6" x 4" x 3.5". Photo courtesy of the artist.

Interleaving

The compost pile encourages generative and symbiotic ways of thinking. It is a substrate for sharing and becoming-with different kinds of bodies. The worms and fungi ingest and regurgitate our collective waste, bringing our bodies into contact but also opening new channels for nutrients and information to meander and touch.

Reflecting on the experience of exhibiting sculptures from my *symbionts of capitalist ruin* series and the installation of */stāj/ 2.1* in the *biometaphysicalmateria: MFA Exhibition*, I am rethinking performance in relation to the bodies that wormed in, passed through, and circled back. In addition to human bodies, I came across the corpse of a stink bug that serendipitously laid a few feet away from one of the sculptures that broke on the gallery floor. Throughout the exhibition, the sculptural bodies asserted their animacy; *Hydrangemedusae* (2023) itself fractured and was regenerated twice before being partially fused to another body. Had the stink bug, nearing its demise, sensed that I regularly combed this space for dismembered bodies that will be regenerated into another life?

The installation of */stāj/ 2.1* also brought humans into my transdisciplinary process. Each body created their own point of entry – physically, in choosing where to enter between the gelatin ropes and figuratively in the way they recognized themselves existing in the space (of a kitchen, lab, or studio.) I even came across a half-eaten bite of food, sitting in a spoon left in an open lunch container. The visitor returned later, explaining that they were so enthralled looking at the work that they forgot their lunch. I had intended to continue working in */stāj/ 2.1* during the exhibition but I was regularly interrupted by bodies stopping in or passing through. Thinking back, I am curious about the ways these bodies performed alongside me, unorchestrated and asynchronously. Perhaps recognizing these experiences as micro performances acknowledges that the sculptures and installations are bodies – porous entities to be engaged with.

The constellation of themes that comprise my practice and research are ongoing, emergent processes in perpetual animation and decay, still compos(t)ing... They contain multiplicities and contradictions and engage with alternate ways of knowing. Thinking through compost means that “we can never fully know what an assemblage or a multiplicity can do, as its agencies are involved in creating "patterns of unintentional coordination"” (Tsing 2015, 23). In

conversation with the 2022 exhibition *Symbionts: Contemporary Artists and the Biosphere* at the MIT List Visual Art Center, my research and experiments moving forward will become-with even more bodies! The changing material bodies of whatever food refuse my community is eating, and the bodies of humans and knowledge that have circled back to my exhibition. The bodies I have encountered become collaborators, meandering alongside me in the compost pile as we turn and aerate it to allow for new microbial activity. My compos(t)ing pauses here with an invitation. I am interleaving blank pages here for myself or others to continue co-experimenting with the ideas in this work. Beyond the boundaries we have traversed together, this project asks us to collectively (re)imagine near futures with alternate ways of being on our planet outside of capitalist gain.

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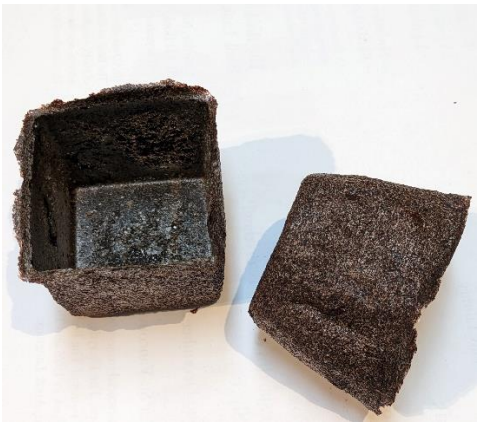
Appendix I: Biomaterial Recipes

This is a growing collection of biomaterials recipes I have developed to date. The following recipes are drafts that will be made available in the Materials Library on materiom.org.

Beet Composite

Recipe Created By: Gwenyth Chao



Difficulty

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Tools

scale, spatula, blender, rolling pin, silicone molds, silicone mat

Composition

Beets	100 grams
Xanthan Gum	5 grams

Method

Step one

Turn your beets into pulp by blending it with some water. Blend until the pulp is not chunky and the texture is consistent.

Step two

Let the pulp drain through a strainer and wait until the water slows to a drip. Do not press down on the pulp to squeeze out excess water.

Step three

While stirring, add the xanthan gum powder slowly so that it can be evenly mixed in.

Step four

Keep mixing and incorporate any clumps that have formed.

Step five

To create flat planes, press the beet mixture on to a silicone mat as evenly as possible. To create a specific thickness, cover the slab with plastic wrap and set 2 pieces of wood with your desired thickness on either side of the slab. Use a rolling pin and roll on top of the beets and wooden guides (this will prevent the slab from rolling too thin or evenly).

Step six

To create specific shapes with molds, use a silicone spatula to spread a thick even layer of the beet mixture on to the outside of the mold. It is not recommended to pour mixture into molds because there will be more warping.

Step seven

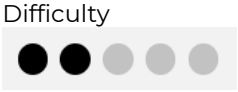
Dry the sheet or molds at 115 °F in a low-temperature oven or dehydrator for 24-48 hours. The beet composite is ready when it slides off the silicone without resistance.

Carrot Clay

Recipe Created By: Gwenyth Chao



Difficulty



Tools

grinder, scale, kettle, spatula, extruder

Composition

Methylcellulose	8 grams
Water	125 grams
Carrot	7 grams

Method

Step one	Dry your carrot (tops or peels) at room temperature or with a dehydrator at 135°F. Carrot material must be dried through to the core.
Step two	Grind the carrot into powder. Powder can be coarser to make hand molding clay. Powder must be fine for coil extruding or 3D printing.
Step three	Make the methylcellulose by adding the boiling water to methylcellulose. Mix until the powder has completely dissolved. Leave the methylcellulose to cool (at room temperature or in the fridge) until the liquid has become a gel.
Step four	Combine 30g of methylcellulose for every 7g of carrot powder. Use a spatula to integrate the gel and powder thoroughly.
Step five	Hand mold the clay or feed into a 3D printer. Note: the clay will shrink slightly and darken in colour after drying.
Step six	Wait 24-48 hours for the clay to air dry at room temperature.

Celery Paper

Recipe Created By: Gwenyth Chao



Difficulty

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Tools

scale, blender, mould and deckle, sieve

Composition

Celery stems	375 grams
Water	10 liters

Method

Step one	Soak the celery in water for a few hours or overnight.
Step two	Fill a blender or Hollander beater half full with water and mix in some of the celery. Blend until the fibers have broken down and the water is pulpy. For smoother and thinner paper, blend until there are no recognizable celery pieces left.
Step three	Place a folded cheesecloth over a sieve and clip it in place. Drain the water well and keep only the pulp. To save the pulp for paper making in the future, freeze in an ice cube tray.
Step four	Fill a large container that is at least 5” deep with 10 liters of water and 375 grams of celery pulp. Agitate the water so the pulp does not sink to the bottom.
Step five	Hold the mould and deckle together and submerge at a 45 degree angle to the bottom of the vat.
Step six	Move the mould and deckle back and forth while slowly lifting it out of the water. The screen will catch the slurry and form a sheet. Opt for a thicker layer of pulp because the paper dries thinner than it appears wet.
Step seven	Let the water drain to a drip and lightly press a sponge to the underside of the screen to absorb excess water.
Step eight	Remove the deckle and couch the mould against Pellon non-woven interfacing fabric. Note: If the sheet is sticking to the screen, use a sponge and press out more water before trying to release it again.
Step nine	Let air dry for 24 hours. Gently remove from interfacing fabric. To flatten the paper that may have warped, mist with water and iron on lowest setting.

Cherry Blossom Paper

Recipe Created By: Gwenyth Chao



Difficulty

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Tools

scale, blender, mould and deckle, sieve

Composition

Cherry blossom petals	275 grams
Water	10 liters

Method

Step one	Soak the cherry blossom petals in water for a few hours or overnight.
Step two	Fill a blender or Hollander beater half full with water and mix in some of the cherry blossoms. Blend until the fibers have broken down and the water is pulpy. For smoother and thinner paper, blend until there are no recognizable petals pieces left.
Step three	Place a folded cheesecloth over a sieve and clip it in place. Drain the water well and keep only the pulp. To save the pulp for paper making in the future, freeze in an ice cube tray.
Step four	Fill a large container that is at least 5” deep with 10 liters of water and 275 grams of cherry blossoms pulp. Agitate the water so the pulp does not sink to the bottom.
Step five	Hold the mould and deckle together and submerge at a 45 degree angle to the bottom of the vat.
Step six	Move the mould and deckle back and forth while slowly lifting it out of the water. The screen will catch the slurry and form a sheet. Opt for a thicker layer of pulp because the paper dries thinner than it appears wet.
Step seven	Let the water drain to a drip and lightly press a sponge to the underside of the screen to absorb excess water.
Step eight	Remove the deckle and couch the mould against Pellon non-woven interfacing fabric. Note: If the sheet is sticking to the screen, use a sponge and press out more water before trying to release it again.
Step nine	Let air dry for 24 hours. Gently remove from interfacing fabric. To flatten the paper that may have warped, mist with water and iron on lowest setting.

Gelatin Rope

Recipe Created By: Gwenyth Chao



Difficulty

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Tools

scale, spatula, sheet pan, syringe

Composition

Gelatin	24 grams
Water	120 grams
Glycerin	18 grams

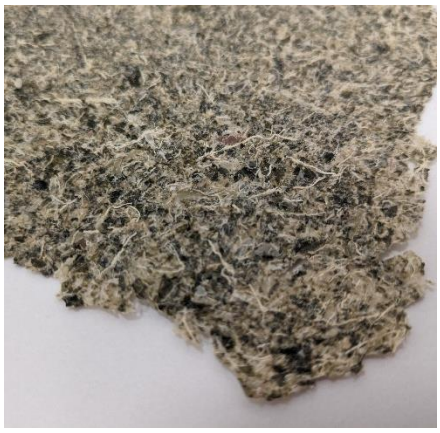
Method

Step one	While stirring the hot water, gradually add the gelatin and mix until completely dissolved.
Step two	Add the glycerin to the mixture and stir until thoroughly combined.
Step three	Put a metal sheet pan (preferably aluminum for quicker turnaround time) in the freezer.
Step four	Wait for the liquid to cool for 45 minutes to 1 hour. The liquid needs to almost set (approx. 87°F). Test the consistency of the mixture by tipping the container to the side in a pouring motion. It should jiggle/ move like honey but not run like liquid.
Step five	Put the jelly mixture in a syringe/ extruder and extrude directly on top of the frozen sheet pan. If the extrusion is flattening out, it is too liquidy and wasn't cooled enough.
Step six	Wait 30mins for the gelatin to set further in its rope form on top of the metal pan.
Step seven	Set a silicone mat out. Flip the metal sheet pan outside down and gently peel off the gelatin rope, letting it fall onto the silicone mat.
Step eight	Let the rope to continue drying for 24 hours. It is most malleable fresh and will become stiffer as it dries. For extra strength, braid the strands together to form a thicker rope

Kale Paper

Recipe Created By: Gwenyth Chao





Difficulty

Tools

scale, blender, mould and deckle, sieve

Composition	
Kale stems	325 grams
Water	10 liters

Method

Step one	Soak the kale stems in water for overnight. If the stems are still very hard, boil for 1-2 hours.
Step two	Fill a blender or Hollander beater half full with water and mix in some of the kale. Blend until the fibers have broken down and the water is pulpy. For smoother and thinner paper, blend until there are no recognizable kale bits left.
Step three	Place a folded cheesecloth over a sieve and clip it in place. Drain the water well and keep only the pulp. To save the pulp for paper making in the future, freeze in an ice cube tray.
Step four	Fill a large container that is at least 5” deep with 10 liters of water and 325 grams of kale pulp. Agitate the water so the pulp does not sink to the bottom.
Step five	Hold the mould and deckle together and submerge at a 45 degree angle to the bottom of the vat.
Step six	Move the mould and deckle back and forth while slowly lifting it out of the water. The screen will catch the slurry and form a sheet. Opt for a thicker layer of pulp because the paper dries thinner than it appears wet.
Step seven	Let the water drain to a drip and lightly press a sponge to the underside of the screen to absorb excess water.
Step eight	Remove the deckle and couch the mould against Pellon non-woven interfacing fabric. Note: If the sheet is sticking to the screen, use a sponge and press out more water before trying to release it again.
Step nine	Let air dry for 24 hours. Gently remove from interfacing fabric. To flatten the paper that may have warped, mist with water and iron on lowest setting.

Lettuce Paper

Recipe Created By: Gwenyth Chao

Difficulty

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Tools

scale, blender, mould and deckle, sieve

Composition

Lettuce stems	400 grams
Water	10 liters

Method

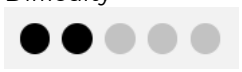
Step one	Soak the lettuce in water for a few hours or overnight.
Step two	Fill a blender or Hollander beater half full with water and mix in some of the lettuce. Blend until the fibers have broken down and the water is pulpy. For smoother and thinner paper, blend until there are no recognizable lettuce pieces left.
Step three	Place a folded cheesecloth over a sieve and clip it in place. Drain the water well and keep only the pulp. To save the pulp for paper making in the future, freeze in an ice cube tray.
Step four	Fill a large container that is at least 5” deep with 10 liters of water and 400 grams of lettuce pulp. Agitate the water so the pulp does not sink to the bottom.
Step five	Hold the mould and deckle together and submerge at a 45 degree angle to the bottom of the vat.
Step six	Move the mould and deckle back and forth while slowly lifting it out of the water. The screen will catch the slurry and form a sheet. Opt for a thicker layer of pulp because the paper dries thinner than it appears wet.
Step seven	Let the water drain to a drip and lightly press a sponge to the underside of the screen to absorb excess water.
Step eight	Remove the deckle and couch the mould against Pellon non-woven interfacing fabric. Note: If the sheet is sticking to the screen, use a sponge and press out more water before trying to release it again.
Step nine	Let air dry for 24 hours. Gently remove from interfacing fabric. To flatten the paper that may have warped, mist with water and iron on lowest setting.

Potato Clay

Recipe Created By: Gwenyth Chao



Difficulty



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Tools

grinder, scale, kettle, spatula, extruder

Composition

Methylcellulose	8 grams
Water	125 grams
Potato	9 grams

Method

Step one

Dry your potato peels at room temperature or with a dehydrator at 135°F. Potato must be dried through to the core.

Step two

Grind the potato into powder. Powder can be coarser to make hand molding clay. Powder must be fine for coil extruding or 3D printing.

Step three

Make the methylcellulose by adding the boiling water to methylcellulose. Mix until the powder has completely dissolved. Leave the methylcellulose to cool (at room temperature or in the fridge) until the liquid has become a gel.

Step four

Combine 30g of methylcellulose for every 9g of potato powder. Use a spatula to integrate the gel and powder thoroughly.

Step five

Hand mold the clay or feed into a 3D printer. Note: the clay will shrink slightly and darken in colour after drying.

Step six

Wait 24-48 hours for the clay to air dry at room temperature.

Tapioca Starch Bioplastic

Recipe Created By: Gwenyth Chao



Difficulty

Tools

Cooker/ stove/ hotplate, scale, spatula, pan

Composition

Water	52 grams
Vinegar	10 grams
Tapioca starch (Cassava root skin)	28 grams
Vegetable Glycerin	10 grams

Method

Step one	Put all the ingredients into a pan and mix on a medium heat.
Step two	Keep stirring as the mixture heats up and until the liquid starts to gel. It will become sticky and have a slime like consistency. Note: Depending on the strength of your burner, turn the heat up to make the mixture more pliable or turn it down if you feel the bottom sticking or burning.
Step three	Once the gel becomes transparent and there's no more liquid, take the pan off the heat.
Step four	Use a stiff silicone spatula to spread an even layer of the gel over your plastic mold. The gel at this point will stick to almost everything except for silicone.
Step five	When you've coated the plastic mold entirely with the gel, let it dry upside down (or anyway where the bioplastic skin isn't directly touching a surface) so that it can set.
Step six	Wait 24-48 hours or until the bioplastic skin is not sticky when touched.
Step seven	To remove the cast, use an exacto knife to cut a seam big enough until you can peel the bioplastic skin off. (If your original plastic mold is thin and flexible, you may be able to slowly peel the plastic off the bioplastic skin without making a cut.)
Step eight	If you do have a seam, cook a small batch of the original bioplastic mixture to use as a glue and use a spatula to gently glue the seam back together.

Appendix II: Documentation of Artworks in *biometaphysicalmateria: MFA Exhibition*

The following pages document the sculptures from the *symbionts of capitalist ruin* series and the installation of */stāj/ 2.1* in photographs. For a video overview of */stāj/ 2.1*, visit https://vimeo.com/showcase/10294722

Day 1 of exhibition

Hydrangemedusae, 2023
Ingestible biomaterial made from rutabaga peels, eggshells, tea leaves, gelatin, xanthan gum (fermented sugar)

Eubrachyuroida echinopsida, 2023
Ingestible biomaterial made from garlic peels, purple cabbage stem, tea leaves, gelatin, xanthan gum (fermented sugar), methylcellulose (vegetable cellulose)

Aulopora clavariscyphozoa, 2023
Ingestible biomaterial made from cherry blossom petals, clementine peel, tea leaves, onion skin, eggshell, gelatin, xanthan gum (fermented sugar), gum arabic (acacia powder)


Day 5 of exhibition

Day 5 of exhibition
a new body forming

Day 5 of exhibition
Hydrangemedusae regenerating into a new body


BRUCE MAU
EGGSHELLS WANTED


ALMOST LOST ARTS
ART THEORY 101-100
THE SENSES
State of Practice
MFA 2023 Exhibition
Muse...
Meet your new Lab Partner
makeshift
NESCO


DIAL-O-GRAM
OHAUS
Cuisinart
MODE
TARE
Not Legal For Trade
Non légal Pour Le Commerce


DIAL-O-GRAM
310g
OHAUS
Not Legal For Trade
Non legal Pour Le Commerce
KASU


NESCO American Harvest
Food Dehydrator & Jerky Maker
Osterizer
Gwenyth Chao
symbionts of capitalist ruin
Ingestible biomaterial made from food refuse
2022


BRUCE MAU
incomplete manifesto for growth
EGGSHELLS WANTED
State of Practice
TOUCHLESS DROP OFF


BRUCE MAU
EGGSHELLS WANTED
State of Practice
MFA 2023 Exhibition
Muse...
Meet your new Lab Partner
Human Set
CONNECTS ARTISTS WITH SCIENTISTS TO SAVE THE WORLD. AND SO ON AND SO FORTH.
WRITE
LINK THINK
salton


NESCAFÉ
amazonbasics
Elo5

View video overview of /stāj/ 2.1 here