University of Gastronomic Sciences

Master in New Food Thinking

FERMENTATION AS MAKING-WITH MICROBIAL LIFE

FOSTERING A SOURDOUGH STARTER AS A WAY TO REIMAGINE MORTALITY

Primary Advisor: Professor Nicola Perullo
Supporting Advisor: Doctor Elena Mancioppi

Teresa Tessari
24NFT28

Academic Year: 2024-2025

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Eight years ago my father died.
Today I turn some of my grief into sourdough.
On a hot summer Monday, I added 125 grams of Tipo 2 flour into a clean and sterilized jar, to it I added 100 milliliters of bottled water. I waited for it to rise, and rise it did. I kept up the feeding, the ratio, fed it more and more often since the temperatures were at an all-time high. A little sourdough starter culture was coming to life. I loved that I started the process in a place and at a time that meant a lot to me: a new community of people had been forming around me and was keeping me alive while I simultaneously kept it alive, in a place where I found space for my passions, for expressing myself fully and for growth. All of it seemed like a meaningful and promising metaphor. However, temperatures and humidity in the small town of Bra at the end of June were too high and I had little time left to spend with some of the people who made up my wonderful community. I was focusing on them and the heat was focusing on my little jar. After a few days the culture inside it was dead. Or was it?
What really happened was that, because of the heat, the starter culture was growing fast. It needed more frequent feeds or less heat in order to maintain the kind of bacteria and yeast that we as humans look for in a sourdough starter. But to say the culture had died would probably be a mistake. It didn't die, the kind of microorganisms that started to proliferate were not the ones I was looking for. Nothing dies in a bacteria culture, all is reshaped, repurposed, finds a new space to live in the interstices of the world. This was the first and perhaps most important lesson I learned from the practice of fostering a sourdough starter, it was from the beginning what I wanted to explore and I found it right away in my jar. Losing the starter that I had worked for and hoped for since the conceptualization of this work was hard, it didn't seem like a good sign but I had observed and noted what was happening to it, around it and to me. Here as well, nothing was wasted.
On the following weekend I headed back to my childhood home, as the middle of summer was approaching and Bra was getting emptier and emptier. I needed to go back to see friends and family and get ready for the times ahead. On Monday, one week after my first attempt, I started a new sourdough culture. New jar, new flour – this time 100% rye – water from the tap. For my first attempt I had kept a diary, wrote down the feeding times and amounts, specified how the starter looked, tasted and smelled. It is not my style but I did it because it was my first time caring for a sourdough culture from scratch and I wanted to base my work around it. I needed to be scientific, I imposed it on myself. This time I started the culture more mindlessly, surely checking amounts and rough times, but nothing as structured as I had tried to do the week before. So much so that I forgot to stick to the jar the usual piece of tape with the date, I just thought I would eventually get to it.
Two days later the starter was growing strong. I was slowly decreasing the amount of rye flour and introducing Tipo 0 flour, as I had learned that the former would give it strength from all the nutrients and the latter – being less nutritious – would keep it steady. Suddenly I remembered I should have written down the date. As I got started with my black marker, I was faced with something I hadn't really noticed when I was making it two days prior: I started feeding this little culture of life on July 7th 2025. Eight years ago, on this day, I saw my father for the last time before he passed away.
This work will not deal with my personal experiences of life and death, but it will surely focus on the importance of the lived experience through the body and on how fermentation can be a tangible approach to grief. If there is anything to be learned from the unplanned coincidences that occurred in these attempts, it is that the beings that inhabit, have inhabited and will inhabit this world are building a trace, a trail, a path that never begins and never ends. It is this path, I too inhabit, that I would like

to explore, being part of the endless reshaping, repurposing and making of new spaces, that have been, are, and forever will be the places of our existence.
Nothing is still, no one dies, everybody is moving, everything is sourdough.

INTRODUCTION

Fermentation, the human acquired practice of transforming food through the collaboration with microorganisms such as yeasts and bacteria, is a wide and interdisciplinary matter, concerning vastly different disciplines: from microbiology to anthropology, from chemistry to philosophy. Simply put, fermentation demonstrates the infinite connections existing within our reality and its consideration can be fruitful both from a practical and metaphorical standpoint. Fermentation holds the possibility to go even beyond the constraints of the human being, highlighting the dynamics of trans-species relationships and their implications in our understanding of existence, of life and death.

This work will be dedicated to the exploration of the practice of fermentation as a means to making-with microbes, in an effort to reframe our existence and reimagine mortality, through the understanding of all life as an endless collaborative continuum of beings. The evidence of this reality can be experienced and understood precisely in the unfolding of human-microbial relationships.

Therefore, the first section of this work will be dedicated to the practical example of making-with microbial life through the fostering of a sourdough starter culture, supported by Sandor Ellix Katz's metaphorical considerations of fermentation and understanding of reality as an intertwined set of relationships, defined as a microbial matrix. Soon, the author's situated experience of co-constructing a relationship with a starter culture will be narrated and analyzed, addressing matters of trust, materiality and grief. The choice of a sourdough starter will be considered in the understanding of this particular fermentation's characteristics and within the framework of the connections between fermented foods, death and grief as explored by Julia Skinner. Finally, considering the fundamental importance of human-microbial relationships in this work, the role and dynamics elapsing between the human and the ferment in question – the author and the sourdough starter culture – will be analyzed, focusing on matters of care and mutuality.

Heading into the second part of the work, the traditional western subject-object duality of knowledge will be put into question in order to explore matters of collaborative and collective existence from a situated standpoint, recognizing humans as part of the endless microbial matrix that constitutes the reality we co-inhabit. Knowledge practices embedded in materiality, namely queering and relationality, will be considered as examples of relevant methodologies, fit to access such reality from the perspective of existence within, with and beyond the microbial matrix. There, the issue of purity will be taken to the forefront and questioned both from a biological and from an ethical perspective, through the contributions of Lynn Margulis's symbiogenesis theory and Alexis Shotwell's ethical and political outlook on the matter. Subsequently, human-microbial relationships will be explored specifically through the examples of fermented foods as vehicles for reality-making and sense-making. The consideration of Maya Hey's theorizations on human-microbial communication will highlight the positioning of human beings as collaborators and co-makers of being and of knowledge and underline the epistemological value of fermentation. Finally, the fundamental matter of culture will be taken into account in its polysemy related to fermentation. On one hand the perspectives from anthropologists Philippe Descola and Tim Ingold will offer understandings on the separation between nature and culture and on the possibility to question and overcome such separation, similarly proposed by Donna Haraway. These considerations will be brought back to the practice of fermentation, where culture also means the proliferation of communities of micro-organisms, including the possibility of degeneration into growths that as humans we may consider related to death. Throughout this section, microbial relationships and fermentation will be recognized, from

various stand points, as situated and bodily opportunities to mediate our relationship with mortality and access survival.

With the acknowledgement of these considerations the final section of this work will begin with the framing of imagination as a generative force, as proposed by Tim Ingold, which will be fundamental in the consideration of death, mortality and grief. Thereafter, the consideration of life as communal and collaborative will be taken into serious account through the practices of fermentation, supported as activism by Sandor Ellix Katz and expressed by Monja Simon in the example of sauerkraut making. The microbial reality of life as collaborative and communal will be explored through the example of fungi proposed by Yasmine Ostendorf-Rodríguez and deepened through the arguments proposed by Anna Tsing, that will center and question the matters of individuality and self-containment. From perspectives on life, we will turn to perspectives of death, seamlessly in the understanding of continuous existence. Individuality and self-containment in death and the related discussions on disgust, offered by Aurel Kolnai, will be considered critically again through the contributions on fungal existence by Ostendorf-Rodríguez and on collaborative survival Tsing proposes. Finally, fermentation will be recognized as a process of making-with, which allows for a mediation with death and a possibility for grief to be expressed and processed. The experiences of fermentation and death, lived and shared by experts whose works will have been fundamental in this discussion, will demonstrate the relevance of making-with microbes as a way of dealing with grief and reimagining mortality.

1. FOLLOWING THE LIFE OF A SOURDOUGH STARTER

Fermentation is a fascinating world, its definition, as proposed by Sandor Ellix Katz, consists in the transformative action of microorganisms. Biologically speaking, however, the term fermentation only defines cellular respiration that occurs in the absence of oxygen. As a matter of fact, most of the fermented food and beverages that we as humans consume are products of anaerobic fermentation, the kind described by the biological definition. However, fermentation is not limited to that strict definition and can be so much more, in its practical sense and beyond.

In his work *Fermentation as Metaphor*, Katz takes his expertise on fermentation a step further affirming that the more he works with fermentation the more he realizes "that what is even more exciting to me about fermentation than its practical manifestations is its profound metaphorical significance".[1] This understanding of fermentation as a metaphor starts from the meaning of the word *fermentation*. Beyond having to do with cellular metabolism it indicates "a state of agitation, excitement and bubbliness".[2] Therefore, Katz brings attention to how many different things beyond biological matter can ferment: ideas, feelings, creativity, and therefore individual and social experience. Furthermore, the lens of fermentation offers the opportunity to look at aspects of human culture – such as religion, art, sexuality, politics – from a different perspective, which sees all of them as forms of bubbly excitement and fermenting expression. Specifically, fermentation is considered as a driver for social change as "when metaphorical fermentation occurs, it often spreads, transforming what was into what's next".[3] Considering fermentation as political does not mean drawing it as a prerogative to a specific ideal or standpoint, but rather understanding its power as a metaphor as well as a practice in order to promote social justice and the reframing of societal and economic structures in a more communal and collaborative fashion. In fact, the practices and metaphors proposed by Katz – and with him many fermentation experts and enthusiasts – are an invitation to activism. In this case, activism is understood as taking action into our own hands – both physically and metaphorically – to turn to the collaboration between the community of humans and microbes as a means to reclaim our relationship with food and its production[4] and to understand aspects of human culture through the lens of fermentation.

The bridge drawn between the practical and metaphorical value of fermentation faces us with the need to consider that its importance in our human life is not limited to its powerful metaphoric meaning or to our food cultures and practices. In fact, we completely, undeniably, inescapably exist not only in a microbial context but because of and tied to microbial beings in a process of co-evolution and symbiosis.[5] As Katz reminds us:

> Fermentation is everywhere, always. It is an everyday miracle, the path of least resistance. Microscopic bacteria and fungi (encompassing yeasts and molds) are in every breath we take and every bite we eat […]. They are ubiquitous agents of transformation, feasting upon decaying

[1] Katz, S. E. (2020) *Fermentation as Metaphor*, White River Junction Vermont: Chelsea Green Publishing, p. 9.
[2] *Ibid.*
[3] Ivi, p.15.
[4] Drain, J. (2020) *Sandor Katz on Interspecies collaboration and reclaiming food through fermentation*, https://thisismold.com/process/cook/sandor-katz-fermentation-as-metaphor.
[5] Katz, S. E. (2012) *The Art of Fermentation: An in-depth exploration of essential concepts and processes from around the world*, White River Junction Vermont: Chelsea Green Publishing.

> matter, constantly shifting dynamic life forces from one miraculous and horrible creation to the next.[6]

In the past decades the great advancements of microbiology and the advent and threats of global pandemics have underlined the importance of avoiding contamination and maintaining purity in an effort to monitor, control and influence the life of microorganisms, acting out what Katz has referred to as "the War on Bacteria".[7] These actions actually constitute a war on ourselves, on our life and on life on our planet as the antibiotics and antibacterial soaps and sterilized practices we put in place to protect ourselves from what ultimately is "our existential context – which – is a microbial matrix".[8] We cannot exist without it and outside of it and while we try to protect ourselves from harmful microorganisms we are impacting also the ones that allow us to exist and thrive, the bacteria that lives on our skin and in our gut, the fundamental ones that are exchanged during birth the ones that allow to preserve fermented foods and make them an all important element of our diet.
However, as reminded by Katz, microorganisms and fermentation are not only fundamental on a metaphorical and practical level when it comes to life but also and possibly more so, when it comes to death. As Markus Shimzu, founder of the Berlin-based company Mimi Ferments, pointed out during a visit to his facilities: there's no actual difference between fermenting and rotting; it is merely an anthropological distinction. While it is true and well accepted that the bacteria that exists on our skin and in our gut deeply affects our life, our physical and mental well-being, and these facts are starting to spread to the general public and influence people's choices, we are more reluctant to face another undeniable fact: we will all at some point ferment.
While fermentation is often thought about in its chemical, biological and gastronomic aspects, and fewer times as a metaphor; death is often thought of as a spiritual, metaphorical event rather than a practical, tangible, biological fact of life. Fermented foods have long been a symbol of life and death and are historically tied to grief "both as comfort food for those grieving a loss and as ritual foods for funerals and other ceremonies. By consuming ferments […] we are partnering with microbial life to honor death and the deceased".[9] Exploring the connections and building an explicit bridge between death and fermentation – not only in their ritualistic sense – can allow for a renewed understating of existence. Through the metaphorical and practical experience of fermentation, we can consider ourselves as a part of the microbial matrix we exist within, recognizing and creating inspiring spaces of coexistence that inevitably become learning grounds and opportunities to reconsider our relationship to life and death, to each other and to the world we live in.

1.1 A sourdough diary

In order to become conscious of these spaces of coexistence, we firstly need to inhabit the relationships they are made up of. Co-living with a sourdough starter is a great opportunity to explore these dynamics first-hand. Here, the journey of a sourdough starter culture will be followed, alternating some personal experiences, some observations about the process and some wider

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[6] Katz, S. E. (2003) *Wild Fermentation: The Flavour, Nutrition and Craft of Live-Culture Foods*, White River Junction Vermont: Chelsea Green Publishing, p. 2.
[7] Katz, S. E. (2012) *The Art of Fermentation: An in-depth exploration of essential concepts and processes from around the world*, White River Junction Vermont: Chelsea Green Publishing, p. 13.
[8] Katz, S. E. (2020) *Fermentation as Metaphor*, White River Junction Vermont: Chelsea Green Publishing, p. 4.
[9] Skinner, J. (2022) *Our Fermented Lives: A History of How Fermented Foods Have Shaped Cultures & Communities*, North Adams: Storey Publishing, p. 243.

considerations. Constructing a relationship is surely an act of care and somehow a creative process; it is a process of questioning oneself and the other, a process of vulnerability and excitement, a process of trust and confidence. All of these aspects cannot be easily reported on paper but hopefully this recording will give some insight into the space of coexistence this starter and I are building together.

Figure 1*: Day 1: The Assembly*

A sourdough starter is a culture of wild yeast and bacteria that can be kick-started simply by mixing flour and water and leaving the mix exposed to air, still partially covered as to select the kinds of microbes we wish to foster. The bacteria in the flour and the air will find a suitable environment for growth and will start producing carbon dioxide. A sourdough starter needs regular feedings in order to be able to keep thriving but humidity and temperature are also fundamental variables to its well-being.

At 11:00 on Monday, July 7th 2025, I mixed rye flour and water to begin my second attempt at a sourdough starter. This is not my first time caring for one but my previous starter was given to me by a friend. I cared for it for years before some bacteria I was not planning for started growing with it. I had to throw it away and only then I realized how much of my diet relied on sourdough starter discard – that is the part of the sourdough one has to throw away when feeding the mother, unless it is being used to make leavened products. I would make savory and sweet pancakes, crêpes and crackers almost every day and now all of those things were missing from my diet and all of those practices from my daily routine. It was a relationship I had fostered for so many years that was now suddenly gone. When I threw away my starter in the trash, I felt angry and sad that I was conscious of the mistakes I had made in taking care of it and that I could not bake bread or focaccia with it anymore. I did not expect that the daily routine of mutual care that we had established would be the thing I would miss the most; perhaps I did not even notice what it really was. Every couple of days, I would take my starter out of the fridge, I would feed them and they would feed me, and what is feeding if not the most primary and fundamental form of relationship? I guess I was grieving.

Figure 2: *A Moment of Grief?*

On the morning of the second day of the new starter culture, life was already showing itself through the glass. At 9:00, the starter had not quite doubled in size but was presenting big bubbles and a strong smell. I was initially put off by the smell, it was deep, dark, not sour nor rotten, but definitely not pleasant. However, I had never worked with rye before and I was in this to learn, not to tell the culture what it should or shouldn't do, what I wanted them to do, I myself did not even know that. So I fed it, this time cutting down the amount of rye and substituting it with tipo 0 flour. After less than seven hours, the starter had already more than doubled in size, so before the evening came, I decided to feed it once again and by night time, I was in doubt if I should feed it a third time or let it be and see what would happen the day after. I opted for the latter.

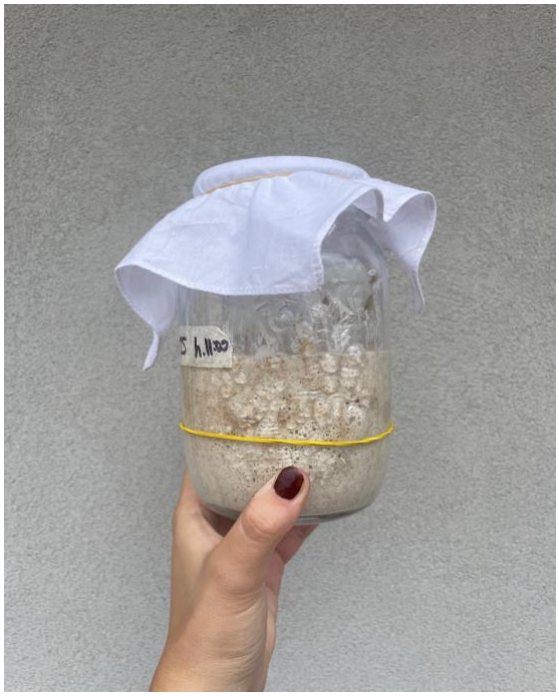

Figure 3: *Day 2: Growth*

The morning after, the smell was definitely sour, maybe too sour. I fed it again, this time with no rye because I did not have any at the time and because I was hoping to slow down the fermentation process. By 13:00, I was worried, I had fed it four hours prior and it showed no signs of rising, only very small bubbles on the top. I texted my friend and colleague Geetika, who in the past year has taught me a great deal about fermentation and, through that, about trusting myself and my instincts. She reassured me at first, but when by the afternoon the starter was again not rising and looking more and more liquid, I thought about feeding it with some rye flour in the hopes of saving it and she agreed it was not looking healthy from the pictures. Sight, when it comes to fermentation, is not much to go off of, especially through pictures. In fact, I was bringing in all of my senses, all of my body, and the emotions that came with it, in order to interpret what the culture might have been going through. By the late afternoon the bubbles were smaller and smaller and the texture was becoming slimier. Geetika noticed the patterns of alcohol forming on the surface, and although its presence does not mean that the culture is unsalvageable, in the heat it is defiantly not a promising sign. Plus, it had been the first sign of decline in my previous attempt so I was getting ready to have to restart the process all over again.

Easy to say on day three, things were not going very well. With the risk of having to create a new starter from scratch was hiding in the back of my mind, I had to practice an exercise in trust. Trust in the process of fermentation, in the culture that was forming, and in my abilities to notice its changes and needs. After all, relationships are about trust.

On the morning of day four, I woke up to a sweet surprise and had to update Geetika on it:

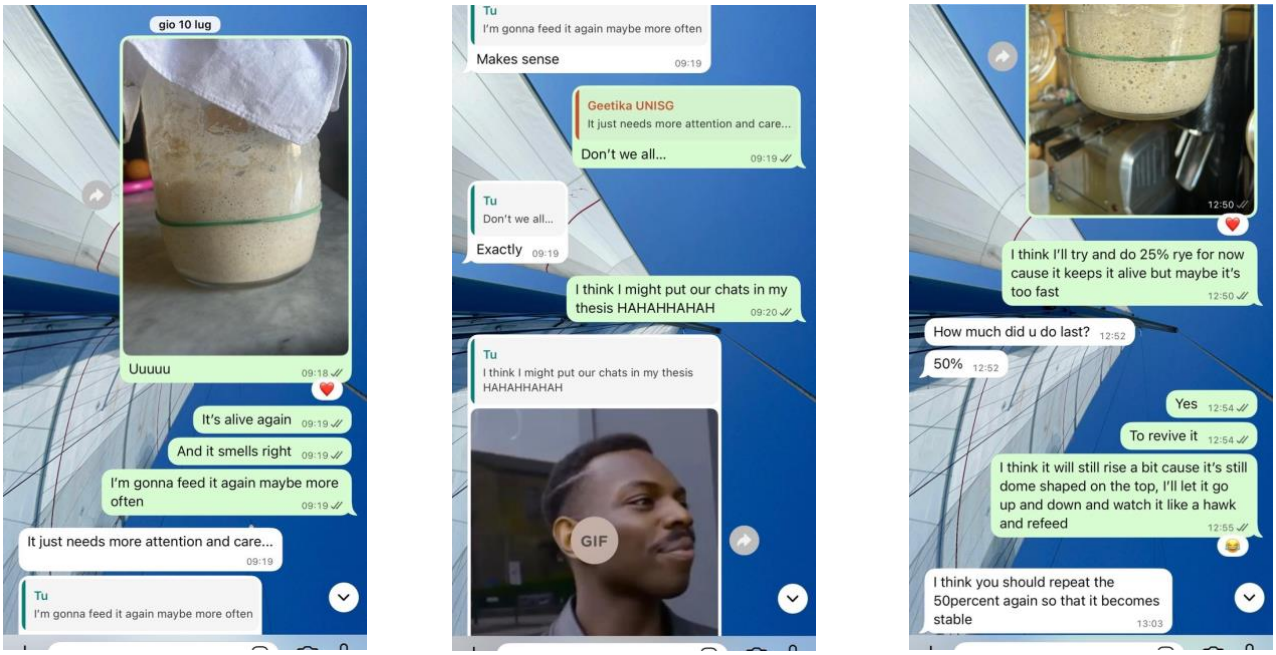

Figure 4: *Day 4: A Newfound Hope*

After a week, a lot of trust and a newfound confidence, the sourdough culture was thriving. I soon left Milan for the seaside and of course, brought my small jar with me, bought the necessary flour to feed it and trusted in its process once again. While there, I had a friend take care of the feeding for a couple of days, and I could not have been more surprised at how well the starter responded to this new relationship that was forming.

Figure 5: *Sharing the Care*

Sharing the care of my starter with friends, seeing them become interested in the process and the relationship that was forming was definitely a reminder and a testament to the relevance that community holds within the world of fermentation – which, we might argue and will later suggest – is nothing other than the whole world. As Monja Simon points out in her work *Sauerkraut* community is a central aspect to be considered in relation to fermented foods and practices of fermentation.[10] Her work focuses on the relevance of sauerkraut in the Black Forest region in Germany: "The practice of Fermentation was a necessary act of survival not only for her family but for the whole village […] The lack of food storage would have resulted in hunger, misery and death. This is why the preservation of food affected the collective survival".[11]

[10] Simon, M. (2023) *Sauerkraut: A Container of Fermented Circumstances*, Eindhoven: Social Design Master Thesis, Design Academy, pp. 20-27.
[11] Ivi, pp. 20-21.

However, the sense of community cannot be limited to the humans that gather around the ferments. The community is built with the ferment, with the sourdough starter in this case, rather than around it.
As the weeks went on, I saw the starter change, develop and get used to living in different conditions. On the days when I had a set routine, the feedings fit perfectly in my schedule but I could not yet take the time to make anything out of it. I was working in a small *azienda agricola* in the north of Italy, hens were part of the farm and the discard from the starter I was fostering was part of their daily diet. Our community was already expanding. At the same time, I took time every morning, in the routine of drinking coffee and feeding the starter, to talk to my friend and colleague about the process of sourdough. She was curious, asked questions, and I suggested she try to feed it someday. Answering to her enquiries, watching the jar quickly get filled up with the bubbly starter in the Italian summer heat and the culture deflating just as fast, grew my confidence and my trust in the partnership we were building. I got to know them – the starter culture – and, in some kind of way, they got to know me: through the touch of my hands, cleaning the spoon and letting the residue on my hands fall back into the jar, part of the starter was influencing me and I was influencing them.

Time passed and I was set to go visit friends, I had to take planes and drive long car rides; bringing the jar along and keeping up with the consistent feeding routine was not feasible. At this moment, the sourdough culture was steady and reliable, I trusted it would be safe to leave it in the fridge for around a week after a good feed. And so I did. Everything went well, in fact, this trust exercise happened twice in a month and the second time around, coming back from my travels and feeding the culture again after ten days in the fridge, it was the most active I had ever seen it. After more than a month or fostering the sourdough culture I was ready to bake with it.

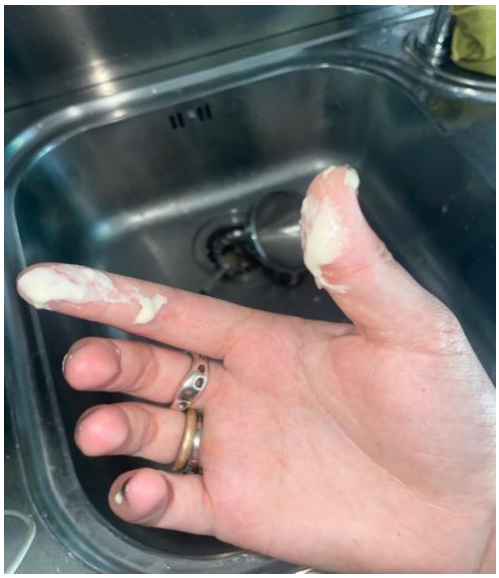

Figure 6: *Meeting and Making-with*

However, life has a curious way of things popping up at weirdly coinciding times. As the sourdough starter was growing and I was fermenting the ideas for this work, some people dear and close to me were going through some hard times of grief. When reading and writing on topics such as this one, collecting and fermenting ideas, we might forget that we are speaking of reality, true beings, experiences, bodies and feelings. In these moments, it is not the time for us to ponder about existential collaborations with microbes. Nonetheless, they will keep happening around us and their actions will influence us and ours will be influenced by them.
I cannot lie, working on these topics at this time makes me feel somewhat hypocritical. There is no circling around it, death is terrible and grief is hard. In fact, hard does not really capture the feeling. It is disarming, disheartening, it leaves us confused and tired, unable to make a step in any direction, while the world around us seems to keep moving and spinning, unconcerned and oblivious to our pain. This section of the work, from the beginning, was supposed to be the diary of the sourdough starter culture I have been fostering and the relationship we have formed together and are cultivating throughout the time I dedicate to this work. However, one cannot pretend that this kind of work can stand independent from the lived experience. As will be argued, there is no getting out from the sticky matrix of life. We, the microbes and I, all the beings on this earth, are situated in the time and place

our existence unfolds. I have baked many breads in these times of grief, I have shared them with those dearests to me along with home-made dinners, preserves and fermentation attempts. It is what I know and my way of making community. If all we can do, while grief crashes and washes upon us like waves on the cliffside, is to sit still and expect the next impact, at least we can be sure we will not be sitting alone. And fermenting a jar of sourdough starter can show how far this non-loneliness can stretch, possibly further than we ever imagined.

1.2 Why a sourdough starter?

So why the choice of a sourdough starter when there are so many fermented foods and processes to be inspired by? In order to speak of the implications, the theory and the understanding that fermentation can bring along, I believed I needed to get my hands into it. Fermentation comes in many forms, but the choice of a sourdough starter was led by my personal experience and context and by a few characteristics that this fermentation process presents. Firstly, I had already cared for a starter and, as mentioned, it was a very important element and relationship in my life for many years. I had been wanting to create one from scratch for a long time, in order to get a similar relationship back and to be able to make bread and focaccia again. Secondly, as Katz points out in his book *Wild Fermentation*, bread is an essential part of western food culture, the one I was raised in, not only in terms of sustenance but as a symbol as well.[12] In fact, I think I could count on one hand the days in my life I've gone without eating bread or mentioning that I did not have bread on that day: for many Italians, bread is a non-negotiable part of every meal. Furthermore, bread is a deeply significant symbol for life and death. In fact, according to Julia Skinner, it is one of the foods most associated with grief and funeral practices, along with pickles and wine.[13] However, beyond these personal reasons, fostering a sourdough starter offers some unique opportunities, as this culture presents some one-of-a-kind features that inform and help outline the understanding of fermentation as a collaborative opportunity to defy time and surpass mortality. Firstly, a sourdough starter culture really can surpass human life; if fed regularly and cared for in the right environment it can be passed down through generations. Its possibility of endless life makes sourdough's ties with grief all the more important. It is the ultimate example of the feeling shared by Skinner "When I create ferments during times of grief, it feels like I am adding life back into the world".[14] In a sourdough starter life is continuously and possibly endlessly added back into the world; it is a constant response to grief and a never-ending answer to death.

The second aspect that makes sourdough a particularly fruitful fermentation practice for this research is that the processes of fermentation that occur in a sourdough starter culture are very noticeable through the senses. Sight is surely an important factor as the sourdough rises and drops at every feeding round, but smell, taste and touch can be even more telling, and they convey the most important and meaningful information about the state of the culture. For example, right before feeding, the starter culture should be flat, with few bubbles and very sour in smell and taste. As soon as it is partially discarded and fed the texture thickens and the smell becomes flatter and flourier. After just a few hours small bubbles appear and the smell turns lactic while the texture becomes more homogenous but still quite firm. In order to understand and relate to a sourdough starter, we must get

[12] Katz, S. E. (2003) *Wild fermentation: The Flavour, Nutrition and Craft of Live-Culture Foods*, White River Junction Vermont: Chelsea Green Publishing, p. 92.
[13] Skinner, J. (2022) *Our Fermented Lives: A History of How Fermented Foods Have Shaped Cultures & Communities*, North Adams: Storey Publishing, p. 243.
[14] Ivi, p. 244.

up close and personal with it, to observe it only through sight is not enough and puts us – the human – on a different level than the sourdough. If we want to create spaces of co-existence and mutual influence and care we must get our hands dirty and our noses wrinkled.
Lastly, as our still short but meaningful relationship shows, a starter culture needs daily attention, if care cannot be provided day by day, then another human caretaker needs to be brought in or the living conditions of the starter must be changed and planned for. If the conditions cannot be maintained the starter culture will change, fostering microorganisms that do not attain the desired effect. It might grow mold or unwanted bacteria. From an anthropocentric standpoint we might say the starter dies, but in an effort to put ourselves fully in a space of learning and co-existence with fermented foods, we should take a step back from our own understanding and open up to the possibility that other beings, such as the yeast and bacteria that inhabit a starter, offer us the opportunity to reframe our understanding of life and death. In fact, fostering a sourdough starter culture from scratch brings to light how unfit the constraints of the beginning and ending of life are in fermentation. The fermentation process is kick-started because the mixture of flour and water is exposed to the air with the yeast and bacteria already present in it. Life is everywhere; it knows no limits and therefore, it inoculates the fertile environment of the elements in a jar. There is no stopping it, and in fact, even when a sourdough starter grows mold or unwanted bacteria, that is not a sign of death but rather of life growing and evolving. It might not be useful for us humans to make bread or focaccia, it might burst out of the constraints of what is controllable by us – not unlike death – and therefore make us queasy and uncomfortable. But it is ultimately a testimony to how the concepts of life and death can be understood in new ways and how we, too, can imagine existence outside those constraints.

1.3 The sourdough and I

Before delving into the understanding of life and death – and therefore existence – in the collaborative and communal fashion that fermentation inspires, one question that has repeatedly come up in my experience with fermentation and specifically a sourdough starter culture, must be dealt with: who am I in relation to the starter? What is my role in this relationship?
As mentioned, we live in a microbial context, surrounded, in and out, by microorganisms that live with, within and among us. While foodstuff can be a lot about making and creating, fermentation is more so a process that occurs in specific circumstances. In fact, while cooking can be said to be the action that separated human beings from other animals and developed us as a species with specific characteristics, fermentation is not a human prerogative; it was not invented by us: "fermented foods […] are natural phenomena that people observed and then learned how to cultivate".[15] One prime example is alcohol, which has been shown to have been consumed – through the eating of fallen fruit – by primates long before the *homo sapiens* species arose.[16] We cannot be considered creators when it comes to fermented foods, not only because they predate us but also and most importantly because we co-create with them.
Furthermore, fermentation puts us in a place of questioning the way we view ourselves as humans in relation to existence, especially in the Global North. Humans here have long behaved, towards other humans, animals, the planet and the facts of life as superior entities, not unlike gods. The Bible teaches that the Christian god has made us humans in his image and likeness inevitably shines through these

[15] Katz, S. E. (2012) *The Art of Fermentation: An in-depth exploration of essential concepts and processes from around the world*, White River Junction Vermont: Chelsea Green Publishing, p. 12.
[16] Skinner, J. (2022) *Our Fermented Lives: A History of How Fermented Foods Have Shaped Cultures & Communities*, North Adams: Storey Publishing, p. 22.

attitudes. In some way, we view ourselves as creators and as having the possibility, the ability and the right to surpass the boundaries of biological life and death. Innovations like biohacking, advancements in medicine, such as the use of AI, accompanied by the tendency of stretching life's length for the sake of living longer – oftentimes to the detriment of dignity and overall health –, the plans – exclusive to some privileged layers of society – to live Earth in favor of life on another planet, all show how humans do not consider themselves as participants of the Web of Life[17] that makes up our existence as inhabitants of the globe, but rather as separate entities that hold power over others, not only non-humans but humans from other societies and parts of the world alike. This standpoint will be deeply put into question in opposition to the collaborative and collective attitude we have the opportunity to explore and learn through recognizing ourselves in the partnership with microbes and fermented foods. Therefore, the perspective of the creator is definitely not the one that describes our role in relation to ferments.

Inspired by Michel Pollan's idea – expressed in his work *The Botany of Desire* – that some plants and animals, rather than having been domesticated by humans, have domesticated us into taking the best care of them or leave them be, Sandor Katz proposes that this might have been the case for microorganisms as well. In other words, is fermentation a form of controlling and shaping yeast and bacteria cultures for the benefit of us humans or have these microbes found a way to shape our behaviors towards creating incredibly favorable environments for them to flourish?

However, the answer Katz proposes to this question proposes to reach beyond: he understands the developments of microbiology as a push towards a colonial relationship between human beings and microbes, which reinforces the aforementioned godly-creator reading on western humans: "they [microorganisms], like other elements of nature and other human cultures, must be dominated and exploited".[18] As explored, we live in a microbial matrix from which we are dependent, while at the same time we do foster environments that make it possible for microbes to grow, develop and flourish. Therefore, Katz urges to consider this relationship outside of a colonial and hierarchical perspective, reminding us of the reality of interconnectedness that makes up our collective existence: "We must stop thinking in such hierarchical terms and recognize that we, like all creation, are participants in infinite interrelated biological feedback loops, simultaneously unfolding a vast multiplicity of interdependent evolutionary narratives".[19]

While the questioning of these perspectives makes it clear that we must not consider ourselves as detached and superior to our microbial counterparts, little has been understood in terms of the role that we do, in fact, play in these relationships. One interesting and fruitful perspective can be offered to us if we deepen our questioning of the idea of fostering an environment in which microorganisms can thrive, while understanding that this is not our sole role in the relationship and that it is not played in a dominating and controlling effort but rather as one of the actions that makes up the complex matrix of the human-ferment kinship. It is here that the concept of care comes into play.

The topic of care is layered and an object of extensive research, especially through the lens of feminism, taking it into account comes with its risks. In this environment, however, it cannot be taken into consideration in its theoretical aspects only. In fact, the issue of fermentation needs to be considered as profoundly connected to its material aspect, which forces the theory to land into a

[17] Capra, F. (1997) *The Web of Life: A New Scientific Understanding of Living Systems*, New York: Anchor Books.
[18] Katz, S. E. (2003) *Wild fermentation: The Flavour, Nutrition and Craft of Live-Culture Foods*, White River Junction Vermont: Chelsea Green Publishing, p. 92.
[19] Katz, S. E. (2012) *The Art of Fermentation: An in-depth exploration of essential concepts and processes from around the world*, White River Junction Vermont: Chelsea Green Publishing, p. 13.

practice and the practice to be questioned theoretically. In light of this peculiarity, and therefore with a particular focus both on the practical and the theoretical aspects of the issue, we can ask ourselves the question: what does understanding the human practice of fermentation as a form of care entail? This question will be introduced here and problematized further in the following sections.

Firstly, in fermentation, care is pivotal in more than one shape and is expressed between different actors, bringing to light a varied set of relationships. In fact, care shows up in fermentation in both a physical and emotional – or metaphorical – way; and it is shown not only between the human and the fermenting beings but as a feature of the human-to-human relationship and of the microbe-to-microbe relationship. Let us focus on the physical ways in which care is expressed: as analyzed, the fostering of a suitable environment for the human-desired microbes to thrive is a capital element of the human practice of fermentation. To attain the proliferation of a certain kind of bacteria – namely Acetic Acid Bacteria or Lactic Acid Bacteria – and avoid the formation of molds or microorganisms detrimental to human health, specific practices have to be put in place, specific ingredients have to be added in the right quantities, and temperatures and times have to be monitored. This aspect is surely a form of care that elapses between the human and the microbes but it is also an inter-microbial form of care as, while the environment is fostered by humans, it is kept stable and developed by the actions of microbes. On the other hand, from the microbes to the humans, it has been shown how fermented foods, and namely the microbes that inhabit and allow for their existence, have a beneficial effect on those who consume them; in fact, the presence of bacteria in the human body ensures physical[20] and mental health and ultimately the possibility to stay alive.

The emotional or metaphorical value of care surrounding fermentation is clearly exemplified by the relevance that food holds in human relationships, as a form of care. Specifically, here we can be reminded of the importance held by fermenting practices and eating fermented foods in times of grief, as explored by Julia Skinner. But generally, the act of preserving food through history was not only a sign of care for the produce but possibly more so a way to be able to feed populations in times of scarcity, a simple act of care.

Finally, as my personal relationship with my own sourdough starter has shown, the act of feeding goes beyond species borders. While I feed the sourdough starter in order to keep it alive, forming an emotional attachment to it, it feeds me back through the emotional value of making breads with my hands, not wasting the part that is supposed to be discarded, possibly taking a piece and gifting it to a friend and finally, enriching the microbiome that inhabits my body. If we are to be considered caretakers, then we share the role with mutuality. While the microbes take care of themselves by maintaining their environment in order to be able to proliferate and I take care of myself and my own kind with making bread, eating it and sharing it, we take care of each other not as collateral damage, but because it is exactly in this form of collaboration that we allow for each other's existence and find meaning in togetherness.

[20] Ivi, pp. 2-3.

2. COLLABORATIVE AND COLLECTIVE EXISTENCE

After having introduced the specificity of my personal kinship with a sourdough starter and the questions and reasonings it has brought along, it is now time to delve into questions of existence holding the consideration of microbial cultures at the forefront. The aim of this section is to consider the existing and possible relationships taking place within, with and beyond our life in connection to microbes. The outlooks, perspectives and theories presented here are a pivotal step towards the consideration of fermentation as a means to reframe the understanding of death and possibly envision a way to defy mortality.

Before then, however, we must frame the reality within which these possible re-imaginations can take place. The reality we exist within, as Katz has underlined, is entirely microbial; this acknowledgement requires us to question the atomistic, individualistic and anthropocentric understanding of life that is paramount in our western society. To do so, we must first understand the biological and ethical implications of existing within such reality, here the contributions of biologist Lynn Margulis and philosopher Alexis Shotwell will be taken into account. Secondly, as inhabitants of such reality, we will deal with the relationships that allow us to come in contact with the microbial other, through the understanding of Maya Hey and her consideration of fermentation as a way of human-microbe communication. Lastly, the issue of the opposition of nature and culture will be dealt with as it is paramount in understanding fermentation practices, especially in regards to the issue of decay. Here contributions from Philippe Descola on the definitions of nature and culture will be accounted for and will support the further analysis of cultural practices by Tim Ingold along with his proposal for the overcoming of the dualistic opposition, as well as the concept of *natureculture* proposed by Donna Haraway. All these contributions will have inescapable links to themes of decay, mortality and death which will be taken into further account in the following section.

Before delving into these considerations, some attention must be dedicated to the ways in which we can experience these understandings, questioning the traditional knowledge dynamics of western cultures in favor of embodied approaches experienced and proposed by communities often left at the margins of such cultures. Questions of knowledge interest and characterize all human cultures, specifically, the western approach to the sciences has been deeply rooted in the subject-object dichotomy based on the understanding of humans as the ultimate subject[21] – and therefore active element of knowledge – can impose their knowing-eye on objects which hold no agency. This outlook has been historically employed in all sciences and is largely based on the distancing – metaphorical and physical[22] – between the subject and the object, which is considered as a virtue and a necessary condition that allows for a clear and fair understanding. This attitude towards knowledge is often accompanied by an effort of categorization which responds to parameters held by the human-subject-agent and is conducted by virtue of their means and their necessities. It is a cycle that continuously feeds itself and remains based on the subject's prerogatives:

> We perceive only that part of nature that our technologies permit and, so too, our theories about nature are highly constrained by what our technologies enable us to observe. But theory and

[21] Descola, P. (2013) *Beyond Nature and Culture*, Chicago: The University Chicago Press.

[22] It is interesting to note how sight has been the preferred sense, deemed most appropriate for knowledge, while senses like smell and taste – which, as shown, hold utmost importance in the process of *getting to know* a sourdough starter – have often been relegated to the sidelines and considered inferior.
On the hierarchy of the senses and the importance of taste as an embodied mode of knowledge see: N. Perullo, (2016) *Taste as Experience*, New York: Columbia University Press.

> technology act on each other reciprocally: we construct those technologies that we think are important for examining a particular perspective of nature.[23]

However, in more recent decades, new perspectives and new considerations of the dynamics of knowledge are being taken into account, explored and proposed. Here, two perspectives will be analyzed as they, if considered together, can give an alternative outlook both on the dynamics of knowledge – outside of the strict subject-agency/object-passivity dichotomy – and on the issue of categorization. The first approach to be taken into consideration is the perspective of relationality, which has been adopted and considered by many thinkers, among them surely Tim Ingold whose understandings will be taken into specific account when the issue of culture as a whole will be tackled. While it might be considered a new understanding of reality if it taken into account in the context of the western tradition of thought, we must be careful not to co-opt and appropriate, not only an idea but a way of living that has been practiced for centuries by colonized and marginalized communities that centralized systems of power have systematically aimed at dismantling. The idea of relationality is founded on acknowledgement that between the knower and the known there is no process of othering or distancing that creates a subject and an object. The colonial roles fade,[24] in favor of a conscious understanding of the reality that surrounds us – as all the beings present in the relationships, that often cannot be reduced into a dualism – is made of a continuous exchange of mutual relationships where no being holds a privileged ontological positioning: it is the shift from an ego-logical way of inhabiting the world to an eco-logical one. When relationality is taken into account as a way of knowledge, it necessarily brings along the notion and actualization of the embodied perspective, which again has been a central topic of debate in recent decades in the West, but has been the way of living and of knowing for marginalized communities and cultures for centuries. The perspective of embodiment considers the body as a site of knowledge, questioning and surpassing the distinct body-mind dichotomy that has led scientific western thought for centuries and that has been the foundation for the process of othering and distancing that has made *knowledge* possible.[25]
The second perspective that will be taken into account is the one of queering. Stemming from the embodied experience of queer people – existing outside the discrete expectations of cis-heteronormative societies – queering is the theoretical effort to "undo[ing] normal categories".[26] Queering can be considered a methodology inspired by a "constant spirit of critique and questioning about the other and the self, from a place of comfort within the non-categorization rather than of fear".[27] Inhabiting, experiencing and speaking through queer bodies does not only open up space for voices that have been long marginalized or shunned; it forces us outside the comfort of the boxes of knowledge, pushing to explore the interstices of existence that have long been willfully ignored or systematically denied. It is important to remember that perspectives such as queering, while they can

[23] Gilbert, F. S., Sapp, J., Tauber, I. A. (2012) "A Symbiotic View of Life: We Have Never Been Individuals", in *The Quarterly Review of Biology*, 87(4), 2012, p. 326.
[24] Or rather were never there in the case of those communities for which relationality is a core element of their belief system and culture. This is not only the case for non-western, colonized societies, it encompasses the experience of marginalized communities in western contexts as well.
[25] The question of embodiment is not a banal one, the philosophy of embodiment is traditionally related to cognition, hence to the human being. Traditionally, it does not seem to include the possibility of other beings being embodied, therefore reenacting the traditional cartesian dualistic model. In this text we wish to consider embodied all the beings that occupy material space in the world.
[26] Haraway, D. (2008) "Companion Species, Mis-recognition and Queer Worlding", in N. Giffney, M. J. Hird, *Queering the non-human*, Aldershot: Ashgate, p. XXIV.
[27] Giffney, N. Hird, M. J. (2008) *Queering the non-human*, Aldershot: Ashgate, p. 5.

be incredibly fruitful as methodologies, if only recognized as such risk falling into a superficial and trend-lead misuse that does not really take into consideration the experience of those who inhabit queer bodies. Therefore, while *queering* can be a methodology, it must be taken on with the understanding that *queerness* is not a practice that can be enacted or not to somebody's liking, it is an embodied perspective, indissoluble from existence. These are fundamental understandings to take on when considering relationally and queering as an integrated perspective as embodiment is the way to knowledge in the relational perspective. While it is surely important to consider the contributions that perspectives like queering and relationality can bring to theoretical arguments, what must not be forgotten is precisely the lived experience of beings that inhabit queer bodies and that have experienced the historical consequences of marginalized relational cultures. The effort to inhabit and explore my personal kinship with a sourdough starter stems also from the importance of being informed first and foremost by my embodied experience.
After having considered and taken on the perspectives of relationality and queerness and their indissoluble connection to embodiment, we can now delve into the considerations of the relational reality within, with and beyond the microbial matrix.

2.1 The community within: questions of purity

Exploring the dynamics existing within the microbial matrix means taking into serious consideration the reality that we do in fact exist as beings fully immersed into it and the consequences that this acknowledgement brings along. Microbes have been studied, first and foremost, as a biological matter but they have been long considered as our predecessors we have evolved from and left behind. This evolutionary model has been put into question by biologist Lynn Margulis. In her studies Margulis has focused on the importance of microbial symbiotic relationships in the context of evolution, her discoveries have given the opportunity to reshape our understanding of life as fundamentally, inescapably tied with the one of microbes as proposed in her theory of symbiogenesis. Here is what lies at the core of this consideration of life, as explained by Donna Haraway:

> An adept in the study of microbes, cell biology, chemistry, geology, and paleogeography, as well as a lover of languages, arts, stories, systems theories, and alarmingly generative critters, including human beings, Margulis was a radical evolutionary theorist. Her first and most intense loves were the bacteria and archaea of Terra and all their bumptious doings. The core of Margulis's view of life was that new kinds of cells, tissues, organs, and species evolve primarily through the long-lasting intimacy of strangers. The fusion of genomes in symbioses, followed by natural selection – with a very modest role for mutation as a motor of system level change – leads to increasingly complex levels of good-enough quasi-individuality to get through the day, or the aeon. Margulis called this basic and mortal life-making process symbiogenesis.[28]

The microbial matrix we have mentioned thus far, is not only an explanatory tool for presenting our interconnectedness with microbes, it is a fact of life and it comes with consequences, namely – against what the promoters of the War on Bacteria described by Katz support – that purity is unattainable, impossible and undesirable from a biological standpoint: "Every living thing has emerged and persevered (or not) bathed and swaddled in bacteria and archaea. Truly nothing is sterile".[29]

[28] Haraway, D. J. (2016) *Staying with the trouble: Making Kin in the Chthulucene*, Durham: Duke University Press, p. 60.
[29] Ivi, p. 64.

Margulis's work is especially notable in considerations around the microbial matrix because while on one hand the theory of symbiogenesis deals with the infinitesimally small, her involvement with James Lovelock in developing the Gaia hypothesis[30] – and the different stances the two held[31] – shows how these forms of collaboration sustain life to an all-encompassing scale. It is the process Margulis recognized as autopoiesis: "the biosphere as a whole is autopoietic in the sense that it maintains itself"[32] exactly in virtue of the life within it as "in our view, autopoiesis of the planet is the aggregate, emergent property of the many gas-trading, gene-exchanging, growing and evolving organisms in it."[33]
In the section titled *A Double Life*, Margulis and Sagan express their complex and never-ending definition of life, reminding how it remains unattainable:

> These halting descriptions approach but stop short of any final definition of life. We will not proffer any last word, final judgement because life will self-transcend; any definition slips away. In day-to-day adjustment and learning, in long-term action and evolution, in interaction and coevolution, organic beings go beyond themselves in the sense that they become more than what they were. Storing and redistributing the energies of the sun, life displays ever greater levels of activity and complexity. Who can guess what life might make of itself if and when it expands to remake a greater part of the universe into its home?[34]

Purity is nowhere to be found. It is impossible, unattainable and undesirable. Not in the practicalities nor in the definitions of life. Not in the microbes nor in the atmosphere, as they are endlessly and filthily intertwined. Not in our own bodies, kept alive by a constant rejection of individuality.[35] Life evolves and exists not despite these facts but precisely in virtue of them, because they constitute what it is inherently made of: life within the microbial matrix is an endless intermingling, a never-ending community made up of contaminating encounters.
When considering issues of contamination as an intrinsic element to the context of life we live in, we cannot ignore what the issue of purity brings up beyond the bios and how the defiance of purity lives within us as more than a biological feature. The so-called War on Bacteria has been tackled in the first chapter of this work, bringing to light how all efforts to wipe away the microorganisms we come in contact with in our daily life are not only unattainable but also dangerous, as we cannot live without them. But in order to explore the meanings of dealing with purity and contamination as features that live within us, we turn to philosopher Alexis Shotwell's work *Against Purity. Living Ethically in Compromised Times*. Shotwell's work begins with the acknowledgment of the constitutive impurity of our existence, which we have just explored thanks to Margulis, from the ethical perspective taken up by the author this inescapability faces us with the fact that all we do is connected to webs of suffering. Contamination therefore is not only a material issue, purity does not exist also in our moral relationship with the world, in fact, Shotwell argues that exactly because it is unattainable, the desire

[30] Lovelock, J. E., Margulis, L. (1974) "Atmospheric Homeostasis by and for the Biosphere: the Gaia Hypothesis", in *Tellus*, 26(1-2), 1974, pp. 2-10.
[31] Onori, L., Visconti, G. (2012) "The Gaia Theory: from Lovelock to Margulis. From a Homeostatic to a Cognitive autopoietic worldview", in *Rendiconti Lincei. Scienze Fisiche e Naturali*, 23(4), 2012, pp. 375-386.
[32] Margulis, L. Sagan, D. (2000) *What is Life?*, Berkeley & Los Angeles: University of California Press, p. 20.
[33] Ivi, p. 23.
[34] Ivi, p. 215.
[35] Gilbert, F. S., Sapp, J., Tauber, I. A. (2012) "A Symbiotic View of Life: We Have Never Been Individuals", in *The Quarterly Review of Biology*, 87(4), 2012, pp. 325-341.

for purity has historically been a desire for control, working in favor of categorization, segregation, individuality and atomization, against community, collectivity and mutuality. The connection between purity, control and politics resonates with the colonial power that has been imposed on microbes Katz has proposed and urged to liberate ourselves from. Therefore, the acknowledgement that we live within a fully contaminated reality, as fully contaminated being and the desire to inhabit this reality, further explore it and collaborate with the beings that we share it with, urges us to take up Shotwell's call against purity:

> I argue against purism because it is one bad but common approach to devastation in all its forms. It is a common approach for anyone who attempts to meet and control a complex situation that is fundamentally outside our control. It is a bad approach because it shuts down precisely the field of possibility that might allow us to take better collective action against the destruction of the world in all its strange, delightful, impure frolic. Purism is a de-collectivizing, de-mobilizing, paradoxical politics of despair. This world deserves better.[36]

It is in light of these understanding of the political connotations of purity that Shotwell proposes to take into serious consideration the plurality and community we exist within in order to challenge the traditionally individualistic conception of ethics. Our impure intermingling with the world is exemplified by the act of eating as a primary impure act: on one hand because it involves killing and death and on the other because it urges us to go beyond our ideas of individuality:

> I agree with Probyn about the idea that in eating we are placed in relation to others, and that bodies shape our horizon of ethics. But I believe that there is no such entity as "the body," or that the body is never only the body: when we understand eating, or energy use, we understand the otherness we carry within, the interdependence of existence.[37]

Therefore, Shotwell urges to consider ethics as necessary embodied "without resorting to an individualized and atomized sense of the body as one's horizon of ethical practices".[38]
Having understood, from a biological and ethical perspective, the implications of living within the microbial matrix and carrying such otherness within, we now take up Shotwell's reference to eating in order to delve into the practice of fermentation as a possibility to explore the relationships we are able to build with microbes and what they may entail.

2.2 The community with: human-fermented foods relationships

In the context of life understood as a constant autopoietic, filthy matrix, paired with the urge to defy purity in favor of a communal, collaborative existence, fermentation can be recognized as a way to collaborate with microbes, offering us an opportunity to face this reality and mediate it through culinary practice. In fact, according to expert on human-microbe relationships Maya Hey, food is a way – if not the way – through which we get to know *the other*, as in the other human as well as the other being. Hey suggests:

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[36] Shotwell, A. (2016) *Against Purity: Living Ethically in Compromised Times*, Minneapolis: University of Minnesota Press, pp. 8-9.
[37] Ivi, p. 120.
[38] *Ibid.*

> Food-as-media enables us to ask the epistemic question of how we come to know plants, animals, or microbes in acts of eating, and to do so with particular attention to how ideas and actions connect.[39]

Specifically, "fermented foods mediate the human-microbe relationship".[40] These relationships and their epistemic value, Hey warns, risk being overshadowed by the traditional knowledge dynamics we have explored that would turn fermented foods in yet another vehicle for separation and elevation of human life above others:

> Current narratives around fermentation oversimplify the human-microbial relationship into dualistic terms, including good/bad bacteria, healthy/harmful foods, or objective/subjective (food) knowledge. This schema for categorizing microbes arguably stems from a desire to organize an otherwise invisible world of microscopic life. However, using these binaries in the context of food discourse positions the human eater at the top of the proverbial food chain, evoking the objectivity of science to claim this superior position (i.e. humans "evolved to be at the top" of such food chains). After constructing this kind of power differential, human positionality remains superior by commanding microbes into service. […] When microbes are not commandeered for the human end-user (i.e. eater), they are often eradicated under the pretense of sanitation and sterilization. This narrative poses two related risks: framing fermentation in terms of human utility perpetuates the myth of human exceptionalism, and rendering microbes as controllable reinforces the idea that they are expendable/erasable by human life.[41]

The risks exposed by Hey recall the War *on* Bacteria described by Katz and support the importance of undoing the binary categories that support such outlooks. A more accurate framing of fermentation portrays it as a practice of collaboration *with* microbes. However, in considering the possibilities of collaboration *with* microbes the issue of communication cannot be escaped. Hey deals with the question of interspecies communication which firstly helps de-centering the human and the exclusively human ways of knowledge and secondly constitutes the basis for exploring the importance of the embodied perspective in such relations.

According to Hey, communication between species is dominated by the seemingly insurmountable issue of incomprehensibility: the microbes and us, we do not speak the same language, at least if we focus on those communications that we as a society have privileged – the intellectual, verbal, content-focused ones. In light of considering microbes incomprehensible, we do not hesitate in speaking for them, also in the context of fermentation. As exemplified by Hey, this is what happens when, seeing a bubbly sourdough starter, we are tempted to describe it as happy. We might suggest that this dynamic repeats itself when, seeing a starter that doesn't rise anymore as we wish it would, or has grown mold, we declare: "It's dead!". It is precisely in virtue of our efforts to rethink and reimagine the understanding of death thanks to the collaboration with microbes, that we must stay with this incomprehensibility and explore the human-microbe relationship through fermentation as it is in these uncanny, relational, non-binary spaces that our understandings can deepen.

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[39] Hey, M. (2023) "Communicating with the Microbial Other: Reorienting humans and microbes in polylogue", in *Global Media Journal - Canadian Edition*, 15(1), 2023, p. 14.
[40] *Ibid.*
[41] Hey, M. (2019) "Fermenting Communications: Fermentation Praxis as Interspecies Communication", in *Public*, 30(59), 2019, p. 153.

In order to deal with the question of incomprehensibility we must widen our perspective, in fact part of it can already be surpassed if we consider that the modes of communication preferred by microbes are certainly not the human preferred ones. Microbes, even within these relationships, do not communicate for us, with this understanding we are faced with another reality: the world – made up of microbes as it is – is not there for us to understand, it is not even there for us in the first place.[42] However some of their communications are not completely inaccessible to us, in fact "our bodies/worlds are in and of themselves instances of biological – and multispecies, hypersocial – networks of information flows".[43] Our communication with microbes in fact, is not an attempt, it is already happening constantly around us. Within it, fermentation can be a conscious effort to engage with microbial life, not in spite of our incomprehensibility, but precisely because of it.[44]
This kind of engagement, Hey reminds, can only be achieved thanks to the embodied nature of the fermentation practice:

> It is by merging manual activity with cognition that I am able to deal with the transitory, the becoming, and the emergent in my body and in fermented foods. With no terminal state or hard-set recipe, how are we to know when to intervene, inoculate, or harvest a ferment? Even with quantified recipes or measuring equipment, I must rely on my senses to 'interpret' the actions of microbial life to 'know' what they are doing. Whether the proof is visual, olfactory, auditory, or tactile, I can assess the done- ness of ferments only if I sense their signs, which I must imprint onto my body as physical memories. With fermentation in particular, embodied knowledge is crucial to my ability to work with the dynamic, transient, and unpredictable.[45]

While we truly cannot insert ourselves in microbial-sense making, through the embodied practice of fermentation we can make sense *with* the relationship, bridging the gaps of incomprehensibility. Ultimately, fermentation is not about communicating some kind of information to the yeast and bacteria that co-participate with us to it, it is not a top-down kind of relationship. And vice versa, as much as we wish and work towards an understanding of microbial life, their actions and mechanics are not being performed for us, in order to tell us something. This does not mean that the relationships that establish in the setting of fermentation are disinterested or accidental, as we have explored, on the contrary it showcases how it is precisely in the process of *making with* microbes that new ways of knowing and new meanings are created, not in terms of content but rather in terms of possibility. The making of my own sourdough starter was born, on my human part, from possibly utilitarian motives but it is precisely in the process of fermenting *with* the starter that I have recognized unexpected and unpredicted paths through ways of knowledge and specifically through grief. As Hey suggests in fact:

> Valuing relational messages over content messages might be one way of bridging communications with incomprehensible others. Relational messages communicate the social dynamics between speakers and listeners through embodied, gestural, or affective means, such

[42] In fact, recognizing that while microbes can exist and thrive without us while we could not survive without them, can be an uncomfortable, perhaps chilling realization.
[43] Hey, M. (2023) "Communicating with the Microbial Other: Reorienting humans and microbes in polylogue", in *Global Media Journal - Canadian Edition*, 15(1), 2023 p. 13.
[44] Ivi, p. 15.
[45] Hey, M. (2017) "Relating To, Working With, and Thinking Through Bodies", in *fermenting feminism*, Laboratory for Aesthetics and Ecology, 2017, p. 26.

> that these messages can still be communicated when textual/content messages remain incomprehensible.[46]

Fermentation can therefore reveal the epistemic value of relational embodied practice in exploring the spaces that escape the binary: making *with* microbes creates opportunities for staying with the incomprehensibility as a way of reimagining precisely the unexplored, uncanny, uncomfortable, unexpected spaces of knowledge outside of anthropocentric, purity constraints. Fermentation as making-with is a space for liberated imagination.
On the other hand, we must take into consideration that to turn the human-microbe relationship into an overwhelmingly positive one would again be a misconception of the dynamics that constitute the microbial matrix. Microbes not only escape the human-preferred lines of communication and modes of communication. They escape the locations, contexts in which humans wish and expect to find them as they exist in the interstices, in all of them. Finding microbes in unexpected places or in unexpected ways – such as the unwanted bacteria that developed in my first attempt at a sourdough starter – is scary, uncanny, it reminds us that there is no escape from them as they are with, within and beyond us. Finding microbes in unwanted and unexpected places puts us face to face with the fact that one day we too will inhabit them, we too one day will transform and ferment, our human-being will be overwhelmed by the microbe-beings that already exist on, around and with us: we will have decayed and in order to decay we will have died. Finding microbes in unexpected places faces us with our mortality, with the inevitability of death. This close relationship will be further investigated in the last chapter of this work. Fermentation, fermented foods in this dynamic can be a space of reassuring interaction, a space of embodied learning through the senses, learning to deal with the inescapably of death, which remains not fully comprehensible but offers itself to be seen not as an end to life but rather as a transformation of it.

2.3 The community beyond: questions of culture

Having now taken into consideration the matters of purity and human-microbial communication, with all that these understandings entail, we may now take a step back in order to enquire on a subject that peaks out of reasonings around fermentation from every angle: the question of culture.
When it comes to dealing with fermentation, the notion of culture is a wonderfully productive one, as Sandor Katz has proposed after exploring fermentation practices around the globe, in fact: there is no culture without culture, meaning there are no communities that do not incorporate any form of fermentation in their practices. While it is apparent that the practices of fermentation are vastly different among cultures, it is interesting – in order to deepen our understanding of the possibilities to reframe mortality thanks to the practice of fermentation – to first delve into the understanding of culture from an anthropological standpoint. Retracing the understandings of culture of anthropologies Philippe Descola and Tim Ingold we will be able to further understand fermentation as a cultural practice.
Thus far, we have considered the question of culture when dealing with the understanding of knowledge and relationships with the other in the situated setting of the West. This understanding of culture – here as in western culture – reflects what Descola proposes as one of the possible definitions of culture, promoted by Franz Boas:

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[46] Hey, M. (2023) "Communicating with the Microbial Other: Reorienting humans and microbes in polylogue", in *Global Media Journal - Canadian Edition*, 15(1), 2023, p. 18.

> The idea that each people constitutes a unique and coherent configuration of material and intellectual features sanctioned by tradition, that tradition being typical of a certain mode of life, rooted in the specific categories of a language and responsible for the specificity of the individual and collective behavior of its members.[47]

According to Descola, this relativist understanding of culture emerged around the XX century in the United States of America and goes on to define the so-called "culturalist" approach to anthropology. However, another understanding of culture has dominated the European philosophical debates for centuries: it is the definition of culture as "all that which, in humans and their achievements, is distinct from nature and imposes meaning upon it".[48] Culture therefore, stemming from Enlightenment thought, represents the original and specific human condition and its ontological domain. Both understandings of the word can be defined in opposition: the former, plural understanding defines the singular culture in opposition to other cultures; the latter is defined in opposition to nature. Nature itself is a concept that is not neutral and is accounted for by centuries of philosophical debates in the West that have culminated in the definition of nature as "an autonomous ontological domain, a field of inquiry and scientific experimentation, an object to be exploited and improved".[49] This primacy of human over nature is largely enabled and justified by the certainty that it is God that has intended this separation and has invested mankind with the duty, right and power to care and create over nature.[50] Descola describes how it is precisely in this opposition that the possibility of enquiry and knowledge of both nature and culture is made possible, in other words, the differences between nature and culture are not ontological, they are created in the process and because of the necessity to understand them, they are epistemological. Surely the epistemology that finds the ideals of nature and culture is inescapably linked, based and re-proposed by the subject-object dichotomy. The relational alternative, promoted by Ingold, would fundamentally question the scaffolding that holds this vision together.

It is important to note how the aforementioned conception of nature is not the only one possible, in fact we also speak about nature when referring to the most true and intimate essence of a being. Evidently, the understanding of human nature, according to Descola is dependent on the conceptualization of nature itself as mankind has identified in opposition to it. It is precisely the codependency of the two ideas of nature that has made them so relevant and so opposite and has made it possible for the human to fully come into his nature as the acts of "understanding and controlling nonhumans are assigned to a subject who knows or one who acts".[51] Finally Nature is there and human nature stands right in front of it.

After having retraced the paths that lead to the definitions of culture indissoluble from the ones of nature, Descola recognizes how the discipline of anthropology is fundamentally based on the oppositions described and defines it as the study of culture, or cultures, "as a system of mediation with nature".[52] In the realm of anthropology, two positions are feasible in regards to the relational possibilities among the two terms: on one hand culture is shaped by nature, on the other nature is

[47] Descola, P. (2013) *Beyond Nature and Culture*, Chicago: The University Chicago Press, p. 73.
[48] Ivi, p. 72.
[49] Ivi, p. 69.
[50] Hereby we are able to take a look back at the reasonings proposed in the previous chapter for the colonial attitude towards microbes and the critique to the idea of humans being the sole creators of fermented foods.
[51] Descola, P. (2013) *Beyond Nature and Culture*, Chicago: The University Chicago Press, p. 70.
[52] Ivi, p. 78.

valued as a reservoir of signs and symbols for culture to draw from. This dualism, Descola insists, has impacted the possibility to consider nature in any other fashion, imposing limitations and consequent ethnocentrism on the study of non-western cosmologies.

While Descola's work *Beyond Nature and Culture*, goes on to explore such cosmologies, we will return on the concept of culture to explore how Tim Ingold has envisioned it and proposed a way to surpass it, specifically in his essay entitled *Three in One: On Dissolving the Distinctions Between Body, Mind and Culture*. Here Ingold proposes his complementary thesis, consisting in the understanding that between human nature – here conceived as the biological facts that make up the human being – and culture there has to be a third element, mediating between the two: that is the human mind. The necessary existence of these three elements is supported by three sciences: evolutionary biology, cognitive science or psychology and culture theory or anthropology. While evolutionary biology and cognitive science both propose specific and independent models of mind and body; culture in the context of culture theory is understood as the corpus of knowledge that is passed down through generations, regardless of their practical application. In this sense, culture is acquired in order to operate in the world and is expressed in the individual behaviors *on* their environment. According to Ingold, these realms share a fundamental premise, for which they have each been criticized already in their individuality: that each one of the specificities that a said realm focuses on – biological structures, intellectual capacities and behavioral dispositions – exist as determined, specified and independent from practical involvement. Opposing to these categorizations, Ingold proposes a synthesis that goes beyond any separations in favor of these realms melting into an organism-person. The new model of the organism-person proposed by Ingold, sees the individual as acting with the environment, contributing to it in an ecological sense, it is the sense of relationality we have mentioned and explored. The organism-person is not a passive location in which evolution takes place, it is a creative agent, resonating with the world around them. The human being and therefore human nature cannot be defined if not in the process of becoming.

Tim Ingold's reasonings on culture develop in light of his understanding of relationality, in fact, when exploring the theme of material culture so dear to anthropology, he critiques the view of artefacts as objects created by the human mind imposing an ideal form onto nature. Instead, he proposes artefacts as processes of making with, as the crystallization of the actions occurring in a relational field. It is in his reframing of artefacts as processes of weaving that Ingold offers a final push against the subject-object dichotomy and in favor of relationality. He proposes the understanding of weaving, as a material, embodied practice, as a process of world-making beyond the constraints of matter and form and the singularity of individuals.

Many other thinkers have tackled the issues of nature and culture, among them surely Donna Haraway stands with her proposal of *natureculture*. The concept, which shares great understanding with Ingold's perspectives, transcends the boundaries between the two definitions in an invitation to recognize the reality of existence which happens beyond them and inhabits all the spaces that we have created between them. Haraway's perspective can help trace our path back to the importance of fermentation in venturing beyond the constraints of culture as opposed to nature. From the necessary understandings of the two terms proposed by Descola, through Ingold's proposal to reframe the human beings as a creative resonant agent who participate with the world through making, Haraway urges us to look back at the overcoming of these separations as inhabiting a world crawling with

critters – which she refers to "promiscuously [to] microbes, plants, humans and nonhumans, and sometimes even [to] machines".[53]
Therefore, let us trace the line back to the beginning of these reasonings around culture: Sandor Katz's analysis of the pervasiveness of fermentation practices around the world, in which he describes the importance of cultural artefacts and learnings around the preservation of foods.

> Information about cultivation, storage, and processing could be communicated and taught. The challenges of fermentation and food storage led to creative solutions such as pottery vessels that constituted major technological advances. Food storage capabilities reinforced the logic of generating surplus food. And surpluses drove the need for more effective storage strategies. Specialization and elaboration ensued.[54]

This interpretation of how strategies and practices for food storage came to be and were passed on through generations, is contradicted in Ingold's understanding of learning which, as has been observed, is dependent on practice, on the relationship with the other – as *any* kind of other – rather than reproduction of behavior. If we reframe fermentation practices through Ingold's understanding of artefacts as material manifestations of making with the world and Haraway's definition of critters as inhabitants of such world, as well as the understandings of embodied epistemologies proposed previously in this chapter, we are offered a new perspective on the possible consequences of fermentation gone bad described by Katz:

> Food storage does not necessarily involve fermentation. In many cases it primarily consists of keeping foods dry but not too dry, cool but not too cold, and dark. But it is not easy, with limited technology, to create ideal conditions for storage. Learning the lessons it takes to dry and store food effectively involves errors and accidents: seeds and grains getting moist, resulting in germination and/or molds; fruits and vegetables fermenting and/or rotting; milk aging in various environments; meats and fish faring quite differently depending upon moisture and salt content. Learning to understand the dynamics of how foods aged under different storage conditions was a necessary aspect of coevolving with the more limited range of plants and animals that agricultural societies increasingly came to rely upon.[55]

Fermentation is a way to live and learn in relation with the other and specifically, when the inevitable issue of spoiling surfaces, it can constitute a co-inhabited path through an embodied and participated understanding of decay. In fact, while accepting Katz's read on the cultural importance of fermented foods in dealing with such matters:

> Distinctions between fresh and rotten food are fundamental, both as a life lesson for survival and as a narrative theme in mythology across human cultures […]. In the creative space between the binary opposites of fresh and rotten is the food that is effectively preserved: the cultured foods, the ferments so deeply embedded in our cultural particulars.[56]

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[53] Haraway, D. J. (2016) *Staying with the trouble: Making Kin in the Chthulucene*, Durham: Duke University Press, p. 169.
[54] Katz, S. E. (2012) *The Art of Fermentation: An in-depth exploration of essential concepts and processes from around the world*, White River Junction Vermont: Chelsea Green Publishing, p. 9.
[55] Ivi, pp. 9-10.
[56] Ivi, p. 10.

We must take our conclusions even further, recognizing that it is in the humanly undesired proliferation of bacteria culture that we learn that decay is all around us, within, with and beyond us. Fermenting and rotting are the same thing and the distinction we impose upon them is merely anthropological, just like nature and culture, what differs is our interpretation of them. Still, before them we are not inert, fermented foods as embodied practices accompanied by artefacts and technologies are a way to co-create worlds and meanings with microbes. Therefore, the process of differentiating between what is fermented and what is rotten can be envisioned as a process of coming face to face with death, of dealing with mortality. Beyond definitions, differences and purity, fermentation offers humans, through their relationship with microbes, a way of grieving-with.

3. COLLECTIVITY AND COLLABORATION AS A WAY TO REIMAGINE MORTALITY

Considering life within, with and beyond the microbial matrix has brought a deeper understanding of the opportunities that fermentation, as a practice that goes beyond materiality and deals closely with issues of decay and death, can offer in delving into questioning existence. After having collected and explored these contributions, it is now time to delve into the possibility that the human-microbe relationship grants us to reimagine mortality. In order to do so, as mortality is a constitutive part of existence, the first step to this understanding is questioning the way of life proposed by microbes and by the practices of fermentation as activism – in the way Sandor Katz has described. The first question we will ask ourselves therefore is: what does our interaction with microbes suggest as the focus of life? As life among micro-organisms and with micro-organisms is necessarily tied to collective and collaborative action, we will explore such themes in opposition to the individualistic model prominent in western society. From these perspectives on life, we will turn to perspectives on death. This will be the space to explore the possibilities of understanding death as evidence of our collective and collaborative existence, highlighted through discussions on matters of disgust – taking into consideration the work of Aurel Kolnai – and survival. Exploring the reality of death through the experience of beings that exist in communal and collaborative modalities, will offer the opportunity to reimagine mortality through the relationship with such organisms. Therefore, the final section of this work will return its focus on fermentation as a way to reimagine mortality and make-with microbial life through death and grief.

Before entering these theorizations, it is necessary to focus on the importance of reimagining and on why imagination is the preferred way to approach such topics; to do so, we turn back to Tim Ingold. In the introduction to his collection of essays *Imagining for Real. Essays on Creation, Attention and Correspondence*, Ingold proposes a new understanding of imagination in relation to reality:

> By imagining for real, then, I don't mean the suspension of disbelief, an excursion into the land of "what if," or the artifice of taking an interior mental model or world-picture for a putative exterior world that may or may not exist in fact. I refer, rather, to a way of entering from the inside into the generative currents of the world itself, by balancing one's very being on the cusp of its emergence.[57]

Imagining therefore cannot be achieved from the security of the mind, hidden away from relations and it has nothing to do with representation. Imagining, in the sense proposed by Ingold, is yet another way to deny the separation between body and mind and it requires and demands the involvement of the imagining-being with other beings around them. Imagining, here, is not a way of theorizing on the environment surrounding us – it is not even a human prerogative –, instead it is a way to make sense and be part of reality, creating it in collaboration – and Ingold's view, in correspondence as "living together in difference"[58] – with the other. We have seen, along the exploration of living within, with and beyond the microbial matrix, how fermentation practices can be a way of knowing and co-creating reality, shedding light and inhabiting those hidden and uncomfortable spaces, the interstices of our being together in a fundamentally microbial existence. In these terms, Ingold's invitation to

[57] Ingold, T. (2022) *Imagining for Real: Essays on Creation, Attention and Correspondence*, London & New York: Routledge, p. 4.
[58] Ivi, p. 6.

correspondence, recalls Haraway's urge to stay with the trouble, settling into those inter-spaces of existence. Fermentation, as explored, can be a way of communicating with beings that inhabit those spaces, making sense with them and exploring the uncanny and uncomfortable limits of life and death. Furthermore, fermented foods are a vehicle and an expression of community – human and non-human –, care and entanglement being practiced daily across the globe, weaving together connections beyond words, categories and species.

As Shotwell has argued, the defiance of purity is inherently political – let us think about the connections between ideals of purity of blood and racism or the accusations against homosexuality as an impure practice, let alone the claims that accompany transphobia – and therefore fermentation, when recognized as a practice founded on contamination and practiced in acknowledgement of the dynamics of collaboration and community that precede and follow it, cannot be lived as a neutral practice. Fermentation defies the logics of singularity and individuality, it manifests the inherent collaborative nature of existence. It is through the understanding of life as such and through collaborating with the microbial other in fermentation that we shall find a path through reimagining existence, therefore life and death.

It is important to note, when taking on the invitation to imagine for real through fermentation, towards a communal and collaborative understanding of existence, that in this need for imagination we are situated. It is in the western, capitalistic and fundamentally individualistic society and cosmology that we look for alternative ways of existence based on trans-species collaboration. Such understandings and relational modalities beyond species already exist in cosmologies and societies different from ours. In proposing this situated understanding we risk overlooking the importance of such experiences and considering our proposition as unique or more relevant than realities that have lived or live in the shadows of our hegemonic influence. This is why the contributions of indigenous wisdom keepers, such as the ones presented by Yasmine Ostendorf-Rodríguez in her work on the collaboration and learning opportunities between human beings and fungi, *Let's Become Fungal. Mycelium Teachings and the Arts*, must be valorized in this context. Furthermore, we must acknowledge that examples of community centered around collaboration, community and specifically fermentation have existed and exist still nowadays also in the western context. One example is proposed by Monja Simon in her work *Sauerkraut. A container of Fermented Circumstances*, exploring the kin-making relationship between the women in her family and the traditional lactofermented cabbage, situated in the Black Forest in Germany. Lastly, oftentimes experiences and testimonies of collaboration and making with fermenting beings and microorganisms are conveyed through the arts – as Ostendorf-Rodríguez's work testifies –, it is the example of the collection *fermenting feminism*, curated by Lauren Fournier, that contains works that will be taken into account in the exploration of these imaginations.

3.1 The focus of life

Before heading into the re-imagination of death we must take a look at what we deem to be the focus of life. The consideration of fermentation offers a particular entryway into the questionings around the focus of life, both from a practical and more theoretical standpoint, with the understanding that, as elaborated in the previous section of this work, the two are not independent nor separate. In fact, in dealing with questions of community, within, around and beyond fermented foods, it puts into question the foundational individualism and atomism that characterizes the western capitalist reality. Sandor Katz has elaborated on his understanding of fermentation as activism, describing how putting action into the food that we choose to eat, fundamentally challenges the centralized food system, based on mass production and mass distribution. Surely, this model puts the consumer at a high risk

of losing their food security and therefore, fermentation can be a great step towards a reconsideration of our food system, towards a deeper and more tangible sense of community:

> Food is critical as an aspect of our economy and the way we've structured our society. This food system is environmentally destructive, wasteful and it's producing products that are nutritionally diminished. We have to change this. Home fermentation is not the singular answer, but I think it can be a very important step in people's attempts to reclaim food. Once the ideas begin to ferment in people's minds they can think, "I can buy some vegetables that were produced at a nearby farm" and "I can spend a little time in my kitchen salting them. Then this mystical process is taking place in the vessel in my kitchen, and then I have this wonderful, nutritious remnant of the warm part of the year that I can use to nourish myself and my family through the rest of the year." It begins this larger process where people might then ask, "What else could I do that would be further reclaiming food? How can I extend this feeling and this action in bigger and broader ways?"[59]

The production of home-made ferments is definitely not an innovative idea, in fact, for centuries and until recent years, a large part of fermented foods were mostly if not exclusively self-produced, with recipes, vessels and microbes being passed down through generations. Most of the time this practice was kept alive and transmitted by women. Monja Simon's ethnographic enquiry on Sauerkraut, deals with the traditional ritualistic practice of making this ferment in the Black Forest in Germany and with its disappearance. In her interviews with members of her female kin, Simon explores the experiences of women and families for whom fermenting cabbage was a necessity. When fermentation comes from a place of need, connection, community and collectivity with the surroundings – human and non-human – are not a secondary, collateral effect, they constitute an inherent element:

> When I asked her about her memories of Sauerkraut, she remembered helping her mother to ferment Sauerkraut in autumn for the colder winter period. The practice of Fermentation was a necessary act of survival not only for her family but for the whole village […]. Annaliese particularly remembers the acts of care and the spatial infrastructure around the Sauerkraut, which would entangle the movements and bacteria of several bodies. She speaks about it like it was something obvious, a collective activity everyone would know how and when to do […]. Annaliese will always connect fermentation with the necessity of this practice as a preservation method to survive in precarious times, which has been the main reason why women in the Black Forest fermented Sauerkraut.[60]

On the other hand, when new technologies and the centralized food system came into play, those formative elements, "the food culture, the collaboration in the village, the intergenerational model of care when preserving food as well as the microbial bodies in the food",[61] got lost, as well as the connection with the land and the community of beings living with it. The detachment from our food practices, especially from fermentation, is detachment from the microbial matrix we exist within.

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[59] Drain, J. (2020) *Sandor Katz on Interspecies collaboration and reclaiming food through fermentation*, https://thisismold.com/process/cook/sandor-katz-fermentation-as-metaphor.
[60] Simon, M. (2023) *Sauerkraut: A Container of Fermented Circumstances*, Eindhoven: Social Design Master Thesis, Design Academy, pp. 20-27.
[61] Ivi, p. 27.

At the same time, Simon's research brings up a topic of extreme importance when it comes to fermentation: the issue of care. As explored, care is a fundamental matter when approaching discussions of fermentation, it is a form of relationship that binds many different actors within the fermentation practice, nonetheless it is not an unproblematic notion. The stories of different women who experienced fermentation in their childhood household, often as a teaching they were supposed to absorb in order to bring it forward as caretakers of their future families, exposes how care – considered traditionally a feminine attribute and value – can constitute a coercion and a forced attitude to be taken on without question, in name of gender roles and tradition. Simon's mother Roswitha grew up on a farm and moved to her husband's family farm once she was married. While her daughter interpreted her always being busy and tasked with jobs on the farm as a natural incline to care, Roswitha describes the feeling of comfort and liberation when the first groceries store opened in the area in the 1970s and she could free herself from the burden of being destined to care for her surrounding beings. For her, fermentation was about relationships of care in a community, but she had no choice in participating in them and they brought on her feelings of exhaustion and alienation. When approaching matters of care, we must ask ourselves if, when those are the feelings that accompany it, we really are speaking of care. The context of fermentation has been shown to be an opportunity to rethink our positioning in relation to the other, showing up as unavoidably circular and communal. With this understanding, we cannot imagine a practice of care towards the other that does not include and entail a practice of care all around, and therefore even towards the self. While topics of self-containment and individuality will be taken into account and questioned in this work, the material experience of women being forced into acts of care cannot be forgotten and must be recognized and acknowledged. Care, as an integral part of community and collaboration, cannot be forced or imposed, as imposition and coercion defeat its very principals.

From the stories explored by Monja Simon, to the urge for an active practice of fermentation invoked by Sandor Katz, it is clear how the centralized food system we are nowadays living in, is founded on ideals that fundamentally erase and deny the value and possibility of community and collaboration, in favor of an atomistic and individualistic reality. Surely, this is not only true for our food systems, throughout this work it has been explored how the very foundations of our models of knowledge are based on the individual, on ideals of difference and primacy and this perspective has been carried out across different expressions of human life in the western capitalist context. In her work *The Mushroom at the End of the World. On the possibility of life in capitalist ruins*, Anna Tsing envisions the possibilities of life after the fall of capitalist reality, taking inspiration from the matsutake mushroom, which thrives in environments destroyed by anthropic action. Before challenging the very idea of individuality and self-containment, she proposes an overview of their importance and pervasive nature in the western context, with effects on systems of knowledge and economic structures:

> Scholars have imagined survival as the advancement of individual interests—whether "individuals" are species, populations, organisms, or genes—human or otherwise. Consider the twin master sciences of the twentieth century, neoclassical economics and population genetics. Each of these disciplines came to power in the early twentieth century with formulations bold enough to redefine modern knowledge. Population genetics stimulated the "modern synthesis" in biology, uniting evolutionary theory and genetics. Neoclassical economics reshaped economic policy, creating the modern economy of its imagination. While practitioners of each have had little to do with each other, the twins set up similar frames. At the heart of each is the self-

> contained individual actor, out to maximize personal interests, whether for reproduction or wealth. Richard Dawkins's "selfish gene" gets across the idea, useful at many life scales: It is the ability of genes (or organisms, or populations) to look out for their own interests that fuels evolution. Similarly, the life of Homo economicus, economic man, is a series of choices to follow his best interests. The assumption of self-containment made an explosion of new knowledge possible.[62]

Notably, Tsing's consideration of individuality goes beyond the personified and anthropocentric perspective. The individual is a finite and defined entity in opposition to others, emerging in that act of othering. This definition resonates with the understanding and critique of the subject-object dichotomy we have proposed and brings up again the issue of purity, which Tsing proceeds to address:

> Thinking through self-containment and thus the self-interest of individuals (at whatever scale) made it possible to ignore contamination, that is, transformation through encounter. Self-contained individuals are not transformed by encounter. Maximizing their interests, they use encounters – but remain unchanged in them. Noticing is unnecessary to track these unchanging individuals. A "standard" individual can stand in for all as a unit of analysis. It becomes possible to organize knowledge through logic alone. Without the possibility of transformative encounters, mathematics can replace natural history and ethnography. It was the productiveness of this simplification that made the twins so powerful, and the obvious falsity of the original premise was increasingly forgotten. Economy and ecology thus each became sites for algorithms of progress-as-expansion.[63]

Tsing's analysis has brought to light the strength and importance of the atomistic and individualistic perspective in our current society, while exposing its limits and its faulty basis. The discussions on purity proposed in this work have exposed how it is an unattainable, undesirable and discriminatory ideal. Therefore, the practice of fermentation can offer us the opportunity to reframe the focus of life through staying with contamination, not only as a political and ethical choice but as the acceptance of the only true reality we are embedded in: our filthy microbial matrix.

The journey through purity, community and culture inevitably brings us to question the idea of individuality. Taking on all the contributions that have led to this point in our discussion, we realize that, as beings making with the microbial matrix, we are constituted precisely in our encounters. They might be unplanned and accidental or intentional and curated, nonetheless we exist not in spite of them but because of them, with them. Individuality and self-containment therefore, are merely chimeras our economic and social systems insist on promoting and limiting ourselves in. It is through observation and active participation to existing and imaginable communal and collaborative dynamics that we can change those paradigms and recognize our belonging, living fully in an endlessly interconnected world.

It is again through the observation of microorganisms and in understanding the relationship with them that we can understand life in a collective and communal sense. One prime example is offered by the world of fungi. Fungi are a fundamental element to fermentation, in fact yeasts are a kind of unicellular fungus. *Saccharomyces cerevisiae* is the name of the yeast responsible for beer and bread and it is one of the main components of any sourdough starter, as well as one of the most evident testimonies of coevolution between human beings and fungi. Biologist Merlin Sheldrake has

[62] Tsing, A. L. (2015) *The Mushroom at the End of the World: On the possibility of life in capitalist ruins*, Princeton: Princeton University Press, p. 28.
[63] *Ibid.*

observed how discussions around the symbiotic relationships fungi – especially lichens and mycorrhizal ones – establish and sustain are often layered with political and ethical understandings. Here, it is important to remind ourselves of the issue of incommunicability: microorganisms are not playing a role we are destined to understand, their lives are not played out for our interpretation. In the reality of incommunicability lies the key to understanding human life not as life above all others, but rather as life *with* others. Evidence of symbiosis is not the reason why microorganisms give us an opportunity to imagine life as communal. It is the acknowledgement that we are part of these entangled webs, that we cannot exist outside or without them, that we too are filthy and contaminated that should lead us in the reimagination of community as the way of life. One other possible misunderstanding when it comes to collaborative and communal ways of living is that this understanding of life comes with a preconception of inherent goodness. In reality, to collaborate and live communally does not always mean that all interests and actions are necessarily aligned. Instead, this conception of life puts at the forefront the entangled reality it exists within: the interest that is shared, is not the primacy of self-contained individuals, but rather the survival of the interconnectedness itself. Individuality – as organisms, species, entities – loses its relevance in favor of community because it is only in community that life is able to flourish.

Going back to the example of fungi, before heading into the testimonies offered by fermentation, Yasmine Ostendorf-Rodríguez offers the opportunity to envision the forest as the ultimate example of collaborative living and underlines the importance of taking time to observe and notice the interrelatedness, knowing that while we cannot see all of it, it is not any less important:

> Spending time in the forest made me see things differently. It taught me to look and look again, calibrating, tuning into details. After every hike, I started to see more co-dependencies, complexities, and layers between all the more-than-human actors. Initially distracted by the heat and damp of the forest, what first looked like trees became intricate webs of relationships and communication. Everything came alive; nothing was identical anymore. Every leaf had a different pattern; some of the bark had been gnawed on, and I now saw insects, fungi and small (and occasionally big!) animals in all colors and shapes everywhere. It is mind-blowing to realize that only a very small percentage of these complexities and interrelations are visible to the human eye. Even more of it happens on a microscopic level, or changes will only be visible over the course of a decade.[64]

Taking time to see the details and consider the absences and presences in the interconnectedness of the world is a crucial and meaningful step towards re-imagination. It is by becoming aware of our surroundings that we can fully, knowingly participate in them. In fact, collaboration in the forest means constantly making worlds for the forest itself, creating context, spaces together where new possibilities for life can erupt. While "most species intuitively maintain some system of ensuring the well-being of the collective",[65] humans often have to sit and listen to the entanglement in order to strip themselves of individualism in favor of participating to the community.

This need for attention and tuning into the world around us can be fulfilled in the practice of fermentation. In fact, fermentation is precisely a process of attention, dedication and selection, firstly in observing and then in finding our space within the developments of microbial life. It is a privileged

[64] Ostendorf-Rodríguez, Y. (2023) *Let's Become Fungal: Mycelium Teachings and the Arts*, Amsterdam: Valiz, p. 186.
[65] Ivi, p. 221.

place to experience community and collaboration beyond species specificity. On one hand, fermented foods help humans to build community around them – as we have seen with Sauerkraut in the Black Forest –, on the other hand it is the privileged location for human-microbe relationships. The potential for community and collaboration that the interaction with microbes in fermentation gives the ability to access is expressed in Maroney's and Nash's visual work titled *Bubbling Bodies and Queer Microbes: Dispatches from the Foundation for Fermenting Fervor*, presented in the collection *fermenting feminism*. The piece is a result of the time the artists spent at Sandor Katz's fermentation school residency and it explores the themes of community and collaboration in light of the queer experience. As explored in this work, queering as a methodology and the experience of queer individuals can be fruitful ways to think about fermentation and the relationship with microbes, as queerness inhabits exactly those same undefined, perhaps uncomfortable spaces shared by microbes. Fermentation innately works beyond the binary, transcends time, questions desire and surely care. Maroney and Nash retrace their time at the Foundation for Fermentation Fervor (FfFF) bringing into light the connection fermentation holds with queerness not only in its practice but also in the metaphorical and imaginary ways we have proposed here as well:

> Playing with microbes in the woods offered us a way of unravelling the entanglements of feminist thought and embodiment with theoretical and practice-based fermentation. The connection of food, fermentation, people, and microbes makes room for rethinking the composition of our individual bodies and social fabric alike. Looking to the microbiome, symbiosis, and symbiogenesis presents us with an opportunity to incorporate the perspective of deep time into our lives and practices. By doing so, we see queer language, space, and bodies, and participate in a world of complexity that overturns the hierarchy of big/small.[66]
>
> For us, as feminists/queer microbe nerds, the location was one where microbial interaction met glitter and overalls, feather boas and work boots, and where genders could manifest in myriad ways beyond normative expectations. Within this space of queer community, the practice of wild fermentation is indelibly linked with radical expression and queer empowerment. Wild fermentation is an act that can be reproduced, but resists codification. Microbes don't express gender per se, but they can sure play dress up. The boundaries enacted to separate gender expression into distinct types cannot hold in this space. They spill out of containment and into liquid, bubbling forms in playful bodies.[67]
>
> The boundaries of human and microbial embodiment became eroded by purple cabbage stains on our hands, tongues buzzing with effervescent liquids, and crevices teeming with the dank living smells of micro-biota we learned to identify in the thick, wet, Tennessee August. We embraced a tactile connection to the creative activities of microbes by caring for miso, sourdough, pyment, sauerkraut, milk kefir, and many other living foods. The range of ferments and diverse cultural histories therein provided context and a sense of temporal alignment with the billions of years of symbiotic relationships that comprise life itself-inspiring scientific and mystical marvel.[68]
>
> Putrefaction, rot, and death well up in the strata around food fermentation, creating a dis-ease around the uncanniness of ingesting some fermented foods. These abject fringes of corporeal

[66] Maroney, S. Nash, S. E. (2017) "Bubbling Bodies and Queer Microbes: Dispatches from the Foundation for Fermenting Fervor", in *fermenting feminism*, Laboratory for Aesthetics and Ecology, 2017, p. 83.
[67] *Ibid.*
[68] *Ibid.*

> existence are apparitions in the orbit of fermentation. Categories, binaries, and hierarchies of self/other, male/female, human/non-human, culture/nature, citizen/immigrant, war/peace, are further disentangled and intersectionally entangled by entry into worlds unseen with the naked eye. Between these binaries, promiscuous microbes transcend – and make a mockery of – our laws. Our signifiers are leaky in a microbial world. Microbes at war, microbes engaged in sex, microbes having fixed genders and gender-based tasks-these concepts are rooted in biocentric binaries.[69]

The recollection of the collaborative experiences at the residency brings out the importance of fermentation in bringing to light the contradictions of the capitalist and individualist reality of our world, retracing the path to the rejection of individuality:

> The practices of sharing food, feeding each other, and nurturing our collaborative life forms in the fermentation residency offered new ways of being in the world that reject techno-fetishist, individualist, capitalist and cis-hetero-patriarchal norms […] Together, in a loose consortium of people, microbes, and food, we cared for each others' multi-species bodies with lively nourishment – and through practices that allow us to fully inhabit and repair ourselves and our gorgeously pluralistic world.[70]

> Microbes know that the individual self is a silly notion, that we are made up in context/community/communion, that the social rules we perform are waxy walls that melt and reshape when we apply pressure.[71]

Fermentation, as has been shown throughout this work, offers the possibility to imagine – in Ingold's understanding of the word – life as communal and collaborative, through practices of making with the other. It is a process of co-construction of reality and meaning, among humans and beyond species, forming and understanding trans-specific collaboration, not creating something anew but fostering spaces for life to flourish. This is, in the end, the reality we live within, which must be acknowledged as going beyond us, beyond singular entities. In our participation in life, fermentation is a way to face and sit with incomprehensibility and therefore with the fact that reality is not made for us to interpret. We are participants in a slimy, sticky matrix we cannot detach and distance ourselves from, like quicksand we are forever pulled back into it. All we can say about life comes from within and fermentation can be a vehicle for understanding, collaborating and contributing, looking and experiencing life as it is, with its contradictions and wonders, trickling into the spaces that might seem empty at first glance but that with attentive observation reveal themselves as endlessly full of being. Fermentation allows human beings to make space for the contaminations that make up life itself: it is the practice of caring with mutuality, community and plurality while staying with the undefined and undefinable. Before this reality the "waxy walls"[72] of individualism and capitalism melt and collapse. While we feed and are fed by the reality of life – which can only exist because of contamination and encounter, beyond self-containment – we share life matter with the ferment and share the ferments with fellow beings, making community beyond limits while tuning into the fine details.

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[69] Ivi, p. 87.
[70] Ivi, p. 85.
[71] Ivi, p. 87.
[72] *Ibid.*

3.2 The meaning of death

In the understanding of life that has been proposed and can be promoted through imagining with ferments, death is an inescapable issue. The refusal of individualism and self-containment urges a questioning of our understanding of death which we can explore from the standpoint of considering all life as fermented.

Taking on the inherent fermenting nature of life, means dealing with the uncomfortable, uncanny, undesired realities of rotting, decaying and dying. In fact, looking closely at the matters we have handled so far, highlights the reality that life is in fact inherently fermented by nature: fermenting is rotting and there is no life without decay. Therefore, all life is fermented. Approaching matters of death and decay from the acknowledging of fermentation as rotting and vice versa, may possibly make these matters more accessible. There is no easing into the discussion of death, and the attempt to understand the equivalence of rotting and fermenting is not meant to be a way to make these matters more palatable or less disheartening. However, fermentation can offer a material and embodied access to questions of death and decay, that may help bridge the gap we often feel and create to endure these matters. Through making-with microorganisms in fermentation, decay becomes tangible, situated and offers itself to the possibility of being explored in action.

All fermentation deals with decay. Decay is in fact, the process and state of decomposition of organic matter through the action of microorganisms – such as fungi and bacteria. As mentioned, before this definition, the distinction and categorization of fermentation and rotting is exposed as merely arbitrary, based not only on what is harmful to the human body but also on what is acceptable in a given context. Fermented foods that are considered delicacies in some parts of the world are viewed as absolutely despicable and disgusting in others.[73]

Disgust is a feeling that is often associated with death. 20-th century philosopher Aurel Kolnai dedicated part of his work to the topic, specifically with his writings *On Disgust* and *The Standard Modes of Aversion: Fear, Disgust and Hatred*. Kolnai's arguments on the topic are complex and layered and based on philosophical matrixes of thought that would need in depth analysis in order to be fully comprehended. Here, the theorization will be taken into account in order to better understand the shift from understanding death in an individualistic sense, in favor of a communal, collaborative perspective. Kolnai describes disgust as a feeling related to the disgusting object, rather than a sense of one's own vulnerability: disgust is about a manner of being and not about being itself. In other words, seeing a disgusting formation – whether it is bodily fluid or a decomposing animal body – causes a reaction of disgust because of the formation itself; understandings about life's precariousness and the possibility of our own death are only consequences of reflection and meditation on the experience. It is important to note that, while Kolnai specifies that disgust should not be the basis of moral judgement, his theorization is based on ideals of purity and efforts of categorization that have been analyzed and argued against throughout this work, as promoters of discrimination and most of all, of unrealistic and undesirable ways of life. What can be picked up in this context from Kolnai's perspective, is his understanding of disgusting formations as evidence of a "surplus of life":[74]

[73] It is the case of Sardinian *casu marzu* – literally "rotten cheese", a Pecorino infested by *Piophila Casei* larvae which turn its insides into a creamy, spicy texture – or Japanese *natto* – fermented soybeans that acquire a slimy, sticky texture and present a strong ammonia smell.

[74] Kolnai, A. (2003) *On Disgust*, Chicago & La Salle: Open Court, p. 72.

> Accentuation, exaggerated representation, swollen overloadedness of vitality or of what is organic, as opposed to norm, direction, and plan of life, framework […]. This surplus of life may be either a matter of some more or less exaggerated aspect of a still existentially coherent individual life (a gross, undignified, as it were perspiring, steaming impulse of life), or the *danse macabre* of living matter of a real existence as a personal being: decay, repulsion and the secretion of substance.[75]

The argument goes on to distinguish between forms of life deemed as lower and those guided by intellect and refers to this outburst of life as belonging only to the former, therefore proposing human beings as a higher form of life as they are not only material in nature. However, it has been shown how, even if we were to take on the cultural consideration of human beings as higher forms of life in virtue of intellect, our life would be endlessly and unbreakably tied to the beings that enable it to flourish and continue: not only the microbes living with us in our organs – without whom our organism wouldn't be able to survive – but all the forms of life that have contributed to our species evolution and co-evolved alongside it.

Though Kolnai's theorization is embedded in a completely different understanding of life – due also to the times in which his work was first published: 1929 – from the one we have promoted and proposed here, the theme of community and the surpassing of self-containment come to play in these pages:

> The surplus of life, in the sense here employed, endeavours to break altogether through any boundaries which may be set upon it and to permeate its surroundings. It thus stands in the sharpest possible opposition to individual formation and to self-containment: one need only consider the concepts of orgy, fornication, or things like tumorous growths, malarial parasites.[76]

The conclusions drawn from this understanding are to be re-elaborated and reframed within the frameworks that have been matured along the theorizations proposed in this work, which interestingly deal closely with the issue of parasitism brought into account by the author. Kolnai, although not denying it, insists that the focus to be extracted from these realizations is not that in death we find a fullness of relationship and community: "it is not the reaching out and embracing, the experiencing of the nature of other beings which concerns us here".[77] However, he recognizes the potential of the feeling of disgust to constitute a catalyzer for the sense of "fusion and confusion"[78] that is experienced in death, though he describes it as an evidence of "universal indifference".[79] Kolnai traces a sharp line between life and death and considers disgusting objects as the uncanny signs of the inescapable blurriness that, rather than dividing them, testimonies their belonging to a continuum. These blurry boundaries are made evident in disintegration, decay and decomposition, they escape any control and are explained as "being taken over by inferior, grosser, vital forces".[80] It is here that we must put into perspective Kolnai's conclusions drawn from this reality: while he claims that "to the individual, the

[75] *Ibid.*
[76] Ivi, p. 73.
[77] *Ibid.*
[78] Ivi, p. 74.
[79] *Ibid.*
[80] Ivi, p. 75.

formed unit of life here signifies nothing but death",[81] we have taken on the refusal of the individual and atomistic perspective and therefore must approach these insights from such a stance.
While Kolnai pushes away and rejects the contamination recognized in decaying matter, the absolute impossibility, undesirability and pervasiveness of purity underlined by authors such as Margulis, Shotwell and Tsing, and the substantial equivalence between decay and fermentation, force us to take into account the unescapable materiality and endless being-and-making-with of our being. It is true that decay faces us with endless "fusion and confusion"[82] and therefore with the impossibility of self-containment but, differently to Kolnai's effort to reject contamination, we sit with its inescapability in an effort to "stay[ing] with the trouble".[83]
Contamination in fact, is the key and the way to collaboration, as proposed by Tsing; it reveals our precarity and therefore emerges as the only opportunity for survival:

> The problem of precarious survival helps us see what is wrong. Precarity is a state of acknowledgment of our vulnerability to others. In order to survive, we need help, and help is always the service of another, with or without intent […]. If survival always involves others, it is also necessarily subject to the indeterminacy of self-and-other transformations. We change through our collaborations both within and across species.[84]

This perspective also reveals the undefined nature of categories, describing them as unstable attempts to trace the precarious boundaries of assemblages. Understood in such fashion, beyond individuality, self-containment and categorization, the reality of mortality – as the boundary between life and death –, reveals itself as a vain effort of containment and security, proven wrong by the evidence of existence. In fact, we might turn again to the example of fungi to find proof of the absence of such confinements:

> Fungi are the interaction between life and death, positioning themselves perfectly to demonstrate that the binary is not as strong as we might think. Life and death are not opposing each other. Fungal bodies and other microbes teach us that death is the transformation of energy. Turning one thing into another thing.[85]

Specifically, saprophyte fungi – the majority of the species in the fungal world – are an example of microorganisms that directly create new life out of decaying matter: in breaking down organic matter, they feed the soil with minerals and nutrients that are fundamental for the growth of plants, they are also the protagonists of the process of composting. Ostendorf-Rodríguez's study of fungi, has brought her to reconsider the prominence of individuality in the understanding of death and the necessity to consider life beyond the visible: it is in noticing the endless life that is in the microscopic or in the layers of reality that we wouldn't traditionally consider that we can find the fullness and entanglement of life that emerges in death.

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[81] *Ibid.*
[82] Ivi, p. 74.
[83] Haraway, D. J. (2016) *Staying with the trouble: Making Kin in the Chthulucene*, Durham: Duke University Press.
[84] Tsing, A. L. (2015) *The Mushroom at the End of the World: On the possibility of life in capitalist ruins*, Princeton: Princeton University Press, p. 29.
[85] Ostendorf-Rodríguez, Y. (2023) *Let's Become Fungal: Mycelium Teachings and the Arts*, Amsterdam: Valiz, p. 113.

Acknowledging life as endlessly related to death, means facing the fact that, wherever we are, we live in ruins and among those ruins we are able to survive in the reality of interspecies relationships. Those relationships are precarious and contaminated, but it is the continuous doing and undoing of them that will keep the matrix we live within, alive. In this context, death is not an escape, it is not pulling out of contaminated life but rather explicit evidence of our belonging to it. Attempts to overcome mortality in an individualistic sense are destined to fail because death is the denial, the rejection of individuality, the evidence of its impossibility. Death is the proof of our existential rejection of purity, our explicit and inescapable bond with contamination. In it the individual, self-contained being is defied, revealing the proof of our connection, of our bond with the endlessly surviving contaminated continuum. The necessity to reject purity in all of its forms and consequences makes itself known in death: we will not end in purity, we will end in contamination and in it the individual dissolves. It is for this reason that individualistic attempts to recreate life beyond death are destined to fail in the attempt to defy mortality: one example is the advent of digital necromancy. The matter is wide and complex, unfortunately it cannot be dealt with in its specificities in this context, however it has been addressed by different experts.[86] Digital necromancy, meaning the attempts to simulate and recreate – often through the employment of Artificial Intelligence – the conscience of deceased individuals, through the digital footprints they have left behind, runs into deep ethical issues. Furthermore, it ignores the material matrix our being is embedded in and leverages on the consideration of human beings as higher beings among the rest, able to access possibilities of knowledge independently from organic materiality. Finally, these ways are based on the premise of human consciousness as a container with accessible contents, rather than an embodied form of becoming, which we have argued is always becoming-with. Attempts to defy mortality beyond materiality run into the issue of the godly-creator complex and highlight a strip separation of nature and culture, topics that have been questioned and argued against prior in this work.

Fermentation, on the other hand, can be an embodied way to deal with the overwhelm caused by the explosion of being, possibility and uncontrollable life death constitutes. With it, and so with the microorganisms we make community with, we take action into our own contaminated hands, to feed our contaminated bodies and do not remain inert in front of the outburst of life Kolnai called disgust. As analyzed through Maya Hey's work, fermentation is a vehicle for making-with as well as for knowing-with while getting us used to the reality of incommunicability and incomprehensibility that explodes in the advent of death. Fermentation has the potential to turn ugly, sour, unpleasant; ferments grow in unexpected ways and can develop stinky smells and off-putting textures, not to mention molds. In front of these events, we might find ourselves unable to understand the reasons or frustrated before the evidence of unplanned realities. But through the senses, through our body and materiality, through the evidence of our mortality, we are able to experience the blurriness of our borders, the permeability and precarity of our being, to recognize decay as a sign of collaborative bursting life. Therefore, in fermentation we mediate our relationship of death as we work closely with the

[86] On digital necromancy and related ethical concerns, see: Osiński, G. (2021) "Theological and Ethical Aspects of Mind Transfer in Transhumanism", in *Scientia et Fides*, 9(1), 2021; Gruvæus, A. (2023) "Beyond Peak Death? – The Advent of Digital Necromancy and Functional Ghosts", in *Journal of Future Studies*, 27(3), 2023, pp. 103-109; Caruana, A. (2023) "Mourning revolutions in the virtual anastasis", in *New Techno Humanities*, 3(2), 2023, pp. 140-147; Hutson, J. Ratican, J. (2023) "Life, death, and AI: Exploring digital necromancy in popular culture – Ethical considerations, technological limitations, and the pet cemetery conundrum", in *Faculty Scholarship, Lindenwood University*, 478, 2023; Hollanek, T., Nowaczyk-Basińska, K. (2024) "Griefbots, Deadbots, Postmortem Avatars: on Responsible Applications of Generative AI in the Digital Afterlife Industry", in *Philosophy and Technology*, 37(63), 2024.

imminent, pervasive possibility and reality of it, turning the experience of making-with into a tool for grief.

3.3 Re-imagining death, dealing with grief and surpassing mortality

This renewed understanding of life and death allows space for new considerations of death and for new possibilities for grief. Considering our existence as panning out in the making-with of sense and reality in the context of a continuous and pervasive bond between life and death, comes with the recognition of existence as a fluid, ever-changing and borderless fact. It is important to note, again, how the close relationship with microbes observed in fermentation, makes it evident that this is the understanding of existence we can propose based on our being situated within the microbial matrix. We are not awarded the capacity to rise above our materiality to explore it from the outside, the matter we live within is too sticky and seeps through the interstices of our being, denying our attempts at self-containment. The matter of stickiness has been brought to the existential level by philosopher Jean-Paul Sartre and, while it constitutes one of the most important contributions to the matter, the reference to femininity, prominent in his description, has been deeply criticized.[87] In his reference to honey as the example of the existential viscosity and sliminess, sticking to the being and to itself and seeping through it, eliminating the borders and defying the longing for purity, Sartre finds a physical reference to the acknowledgement – which he finds somewhat enigmatic and nauseating – of the ontological continuity between the self and the world. It is the realization prominent in his literary work *Nausea*, which leads the protagonist Antoine Roquentin in his constant feeling of horror in being too much for the world – similarly to how Kolnai referred to disgust as the feeling of a surplus of life – but ultimately to the freedom of being. The notion of slime, viscosity and stickiness in reference to life and death is explored and argued in detail in Sartre's masterpiece *Being and Nothingness*:

> Slime is the revenge of the In-itself. A sickly-sweet, feminine revenge which will be symbolized on another level by the quality "sugary." […] A sugary sliminess is the ideal of the slimy; it symbolizes the sugary death of the For-itself (like that of the wasp which sinks into the jam and drowns in it). But at the same time the slimy is myself, by the very fact that I have outlined an appropriation of the slimy substance.[88]

While ferments present strong links to matters of sliminess and sometimes stickiness, the contact with such viscosity as presented here, does not hold such off-putting and nauseating meaning; instead, more similarly to Gaston Bachelard, viscosity is seen as a space for possibility and coexistence for those who work actively with it.

In fact, in the mediation of mortality through fermentation we find ourselves never alone, but rather in the acknowledgement of the microbial matrix we co-constitute: while we collaborate and feed each other – human-to-human, microbe-to-microbe, human-to-microbe and vice versa – we are recognizing ourselves as beings part of the microbial matrix, its mutuality and its circularity. Furthermore, in the relationship with ferments we experience the blurriness of our borders, the

[87] Heinämaa, S. (2009) "Psychoanalysis of Things: Objective Meanings or Subjective Projections?", in Daigle, C. (ed.), *Beauvoir and Sartre: The Riddle of Influence*, Bloomington: Golomb J. Indiana University Press, pp. 128-142.

[88] Sartre, J. (2018) *Being and Nothingness: An Essay on Phenomenological Ontology*, London: Routledge, p. 630.

permeability of our being, we mediate our understanding of death as we work closely with the imminent, pervasive possibility and reality of it.

It is precisely in recognizing ourselves as having no borders, no limits and being made up of continuous encounters that we can find grounds for re-imagining death. As Tsing has proposed, survival is feasible only in a collaborative and collective fashion, as those are the only true connotations of existence. Therefore, in death, we find the opportunity to trust that, while our understanding of the individual may perish, the collective will live on. Here, the practice of fermentation allows for a material, tangible proof of such reality thanks to the existence of traditional practices being passed down through generations and through the ferments that out-live their human counterparts, carrying part of them beyond their perceived individuality.

The question of trust has been brought up in the first section of this work, in the description of the relationship built in the fostering of a sourdough starter. Trust is an essential feature of any kind relationship, across species differences. In the context of fermentation, it connects humans back to their materiality; in fact, trust in fermentation is a matter of processes. On one hand, the processes that involve our senses: fermentation, practiced in the everyday, by all people on the planet, relies on the material understanding offered by the human senses in order to understand when things have gone right – and the fermented food is safe for humans to consume and tasty to their liking – or if they have gone wrong. The opposition between right and wrong here is not given as an absolute, as mentioned fermented products that are considered delicacies for some, would be deemed as "gone wrong" by others, not only in terms of traditional taste preferences or aversion based on cultural practices but also based on individual likes and dislikes. Fermentation experts and enthusiasts know this well, and encourage others to get up-close and personal with their fermented experiments – often leaving behind chemical and technical analysis – in order to frame their understandings of them. Smell, taste and touch are in fact often the biggest indicators of a ferment's status and they allow the human actor to modulate some changes in the environment being fostered for the microbes, in order to encourage or inhibit particular outcomes. In his work *Wild Fermentation*, Sandor Ellix Katz describes fermentation practices as processes of learning in working-with human-microbial relationships:

> My advice is to reject the cult of expertise. Do not be afraid. Do not allow yourself to be intimidated. Remember that all fermentation processes predate the technology that has made it possible for them to be made more complicated. Fermentation does not require specialized equipment. Not even a thermometer is necessary (though it can help). Fermentation is easy and exciting. Anyone can do it. Microorganisms are flexible and adaptable. Certainly there is considerable nuance to be learned about any of the fermentation processes, and if you stick with them, they will teach you.[89]

Furthermore, Katz encourages trusting in the senses as features of materiality that can help detect where the human actor draws their personal line of decay, part of which is certainly based on taste:

> If it looks or smells disgusting, feed it to the compost. Usually I find that the funkiness is limited to the top layer, which is in contact with the microbe-rich air. Underneath that, the ferment is fine. If in doubt, trust your nose to be your guide. If you're still in doubt, taste just a little bit. Mix it

[89] Katz, S. E. (2003) *Wild Fermentation: The Flavour, Nutrition and Craft of Live-Culture Foods*, White River Junction Vermont: Chelsea Green Publishing, p. 28.

> with your saliva and swish it around your mouth like they do at wine tastings. Trust your taste buds. If it doesn't taste good, don't eat it.[90]

Another way trust comes up in the practice of fermentation, is in the interaction with the developments of microbial life in fermented foods. Microbial processes, not visible to the naked human eye and not fully processable through human understanding and language, work regardless of our awareness and grasp of their dynamics. While there are chemical and biological explanations to how a mix of flour and water controllably exposed to air turns into a bacteria and yeast culture that allows humans to create leavened bread, we have explored how not everything can be reduced to its technical explanation, as technology is deeply based to what humans deem important looking for. Furthermore, even the chemical and biological data we are able to collect on these processes depend on our materiality and our senses, broadly through our experience. Again, matters of incommunicability and incomprehensibility resurface: the world is not panning out for us to understand and explain it, we are a part of it and we can only access knowledge through living – and dying – with it. It is Maya Hey's proposal of the epistemic value of our relationship with microbes in fermentation, which highlights our place as co-participants and co-makers rather than creators and deciders. This reality has become even more evident after the considerations made about death and the possibility of defying mortality through collaborative survival.

In the practice of fermentation, while we care – knowingly or unknowingly, willingly or unwillingly – for other co-participant beings, they do the same for us and they will do so even, and somehow especially, in death; on one hand, through the re-purposing of energy in the process of decay and on the other, through making-with the ones we leave behind if they turn to fermentation. At the beginning of this work, framing the dynamics between the sourdough starter and I, this relationship had been framed as revolving around matters of feeding: while I feed the sourdough starter, they feed me back. On the same wavelength, Shotwell argues how eating is the basic form of relationship in the world. This acknowledgement brings matters of purity and death to the forefront, as there is no possibility of stepping out from the inevitable systems of suffering eating necessarily revolves around. Shotwell therefore calls for a questioning of the systems in which this suffering is happening. On our end, this work has been an exploration and deepening of such relationships, questioning systems of knowledge and of reality, finding a new understanding of existence and new possibilities for dealing with the inherent mortality of all life.

In fact, beyond all theoretical understandings of existence through the lenses of fermentation, we now have the opportunity to deal with material, lived examples of making sense of death with microbial matter, which all come from authors and experts that have informed this work. Firstly, we refer again to Katz, whose relationship with fermentation has been pivotal in his coming face to face with his own mortality:

> During this same past decade that I have developed my fascination with fermentation, I have spent a fair share of my fantasy life pondering my own decay and death. How could I not imagine it after receiving the HIV-antibody test death-prophecy? […] I feel there is wisdom in making peace with death. It will come. All I can do is embrace life as best I can, and when I die, I know, I believe, I have faith, that all that is me will continue to be part of the cycle of life, fermenting and

[90] Ivi, pp. 33-34.

> nourishing and becoming myriad other life forms. My fermentation practice is a daily affirmation of this faith.[91]

Katz describes fermentation as a sort of ritualistic practice that reinforces the system of trust we have supported. These considerations and the practices of fermentation, as proposed in this work, are not meant to be spiritual realizations, though they might be for some, they instead aim at an acknowledgement of the reality of our existence, and promote the opportunity to make-sense-with the relationships with beings that life has to offer.
Skinner as well has shared the importance of fermentation in her dealing with death and her personal story shows the possibility of bridging the gap between a theoretical understanding of fermentation as a possibility to defy mortality and the practical opportunities it offers. Skinner describes a period of her life during which she – in a very short span of time – lost her mother, her grandmother and her best friend; and how she turned to fermentation almost instinctively as a tool for dealing with grief:

> When she passed, the urge to let that grief envelope me was enormous: I had barely begun unpacking one loss, how am I suddenly supposed to unpack three?
> The thing that kept me sane was vinegar.
> Vinegar making is a multi-step process that allows us to witness transformation in several ways: starting with raw ingredients, which transform to alcohol, and finally into vinegar.
> Watching transformation on a microbial scale is a reminder that change is universal, and watching that transformation result in something beautiful and delicious is a hopeful reminder that even massive, world-upending shifts can bring positive outcomes.
> On my last visit with grandma, she asked for her apple salad, a simple mayonnaise-based salad with diced apples and walnuts.
> As I peeled the apples, I tucked their peels and cores into a jar, adding sugar and water to begin the process of fermenting them. I did it almost absentmindedly: As though an unseen force took over and guided me. I had no reason why I had to make vinegar, right there and right then, I just did, and ever since every time I hear that pull I listen. When she passed, the little jar and I started to make our way back home, the jar bubbling away as we went.
> When I got there, I opened the lid, and the smell of the vinegar instantly transported me to her kitchen, and of good memories that helped to displace the sharp pang of loss.
> Around the same time as grandma's death was Justin's funeral, during which a friend dug up the last carrots Justin grew, handing them to me.
> I cradled the carrots throughout the funeral, handing out bits of carrot tops as a snack to interested fellow mourners. I'd say this is an uncommon occurrence, but it's actually pretty standard behavior for me at any social gathering. What was less common though, was the task of trying to turn those carrots and tops into as many foods as possible to share with friends: A way for us to collectively remember through digestion and reflection.
> The carrots themselves became pickles, the tops turned into vinegar. Just as I had with the apples from grandma's house, I opted for a wild fermented vinegar, allowing the microbes from the soil tended by my friend's hands to transform our food into something that could nourish the people he left behind.
> Both jars smelled like the places Justin and grandma both lived: In a very real way, it felt like I was carrying on her memory through the living food I made during our last week together. And in keeping a piece of her alive through food, I felt like I had a safe space in which to process my grief: One that acknowledged the loss, but acknowledged the hopefulness and healing that comes

[91] Ivi, pp. 159-160.

> with connecting with the good memories of lost loved ones. Making and tending to the vinegar helped me realize that even in the depths of grief, we can create something beautiful and made with love.[92]

Skinner's story brings into focus the importance of life living at the borders, in the interstices and the opportunity that we have, through fermentation, to foster those spaces, feed them and inhabit them. Furthermore, it underlines how community is not made only with those microscopic and invisible beings that work with us in fermentation, they are in fact a fundamental part and bridge of community among human beings beyond the apparent constraints of individual life, a matter of incredible importance in times of grief.
This reality is shown evidently in Maya Hey's contribution, which deals with matters of death and decay on a layered level:

> I recently had to save Gigi from an opportunistic yeast after I left town for a few weeks. Nothing out of despite or neglect, I'd just taken for granted that some ferments (like the beer sitting next to Gigi) can quietly bubble away, while others needed more regular tending. You see, Gigi is the last living iteration of their human form: Gigi-the-human is no longer with us, but Gigi-the-sourdough-starter lives on in kitchens like mine. It was passed down from Gigi's hands through mutual friends, and subsequently bequeathed to me. I'd never met Gigi in person, but our bodies encounter each other nevertheless.[93]

On one hand, the fact that among the Gigi-the-sourdough-starter culture grew a humanly undesired yeast and the way Hey chooses to talk about this form of life, reminds how death is not an option in fermented life. The starter did not die because an unplanned microorganism started collaborating and co-existing with it, furthermore Kahm yeast, the kind that developed with the culture in question, is not harmful to human beings and can easily be recognized and removed from ferments. On the other hand, this consideration falls directly into the consideration of Gigi-the-human's life. As proposed by Hey, the life of Gigi has been expressed in multiple, connected, contaminated forms, there is continuity among them and individuality dissolves in their acknowledgement, while the memory of Gigi-the-human remains imprinted in those – humans and beyond humans – who have crossed their path and forever will again.
Finally, again, individuality is lost in the evidence of existence in fermentation. Having considered life as a constant making-with of reality, we can be sure that even in death our legacy – whatever we believe that might mean – will not be lost. In fact, it is just an emergence, a surfacing of the continuous collaboration that makes up our collective survival. Just like categories, as proposed by Tsing, are unstable and momentary grasps of a continuous reality, individuality is a fleeting expression emerging from the matrix of encounters and contamination we have come to know as existence. Our momentary human form will inevitably transform and live on, like fermenting beings in an open-lid jar. As Yasmine Ostendorf-Rodríguez writes: "transformation is the best conservation, a metamorphosis to extend a lifetime in a new form".[94]

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[92] Skinner, J. (2023) *Cooking with Ghosts: A Story of Wild Vinegar, Grief and Home*, https://rootkitchens.substack.com/p/cooking-with-ghosts.
[93] Hey, M. (2019) "Fermenting Communications: Fermentation Praxis as Interspecies Communication", in *Public*, 30(59), 2019, pp. 149.
[94] Ostendorf-Rodríguez, Y. (2023) *Let's Become Fungal: Mycelium Teachings and the Arts*, Amsterdam: Valiz, p. 113.

Changing the paradigm of life – from individuality to community – allows for experiencing a reimagined sense of grief. Its feeling won't be less disheartening or painful. Fermenting these ideas and practices is not about making death seem like "a good thing". It is not. It just is. However, death is not "a bad thing" because it is evidence of decay, but rather it is a recognition of how things, people, ferments, can change shape, size, form and become less accessible to our limited, human understanding. Sometimes, rightfully so, we would want them to stay exactly as they are, only to realize that the way that they are is ever-changing, transforming, always moving. Death is an explosion of life, life spilling out from all sides, a sudden and continuous expansion of possibilities of being. It is uncanny, it is scary, it calls for control. But we can abdicate that desperate and impossible need for control turning to community. When in the face of death, overcome by grief, all our certainties fail, and we find ourselves contaminated by doubt, sadness, anger and disheartenment, community glows in the interstices. In the meals prepared by a loved-one, in waiting for a sourdough starter to smell funky, for bread to rise, for fruits to ripen and for jars to bubble. Life does not need our action to happen, if we need to, we can just sit in the river and let the current take us. However, if we wish to, we can dirty our hands – which have never been clean – and touch, smell, taste and exist-with ferments.

CONCLUSION

This work has traced a path to recognizing fermentation as participated evidence of beings – human and microbial – to the matrix of existence intertwining our collective lives, allowing for a reconsideration of life beyond individual self-containment and a reimagination of death through collaborative and collective survival.

The practical and theoretical account of fermentation began with the narration of a personal, sensorial relationship between the author and a sourdough starter culture. In virtue of such co-creation, the importance of themes such as trust, community, care and grief has been introduced, alongside the acknowledgement of such matters as on one hand, fruitful arguments and theorizations, on the other, material, lived experiences that involve bodies and emotions and cannot be separated from the disheartening feeling death and grief bring along. The choice of a sourdough starter culture as the fermentation to form relationship with has been accounted for and supported by the contributions of experts, namely Sandor Ellix Katz and Julia Skinner, whose analysis have offered the chance to recognize human life as living within a microbial matrix and have underlined the importance of fermented food making and consumption in times of grief, as an effort to add life back into the world.

Subsequently, the traditionally western subject-object knowledge dynamic, with its consequences of categorization and discrimination, has been questioned. In its place, participatory methodologies, such as queering and relationality, have been proposed. Following such reframing, life within the microbial matrix has been recognized as collaborative and collective firstly from a biological perspective, thanks to the theory of symbiogenesis proposed by biologist Lynn Margulis and then from an ethical standpoint, through the account of purity as an undesirable and unattainable fact by Alexis Shotwell. Understanding life within the microbial matrix, has led to contamination being recognized as the only possible reality for existence. The exploration of the microbial matrix has been deepened in the consideration of the relationships it is made up of. The human-microbial relationship developing in fermentation as analyzed by Maya Hey, has revealed fundamental matters of knowledge and incommunicability, which have contributed to recognizing the human being as a constituent part of the microbial matrix, able to access it only through bodily experience and collaboration. Here, the human-microbial relationship developing in fermentation has been shown to offer possibilities of mediation with death and mortality through making-with and making-sense-with microbes. Finally, the polysemic question of culture has been taken into consideration with the contributions of anthropologists Philippe Descola and Tim Ingold. Their accounts of the opposition between nature and culture, and the effort of surpassing such categories – supported also by Donna Haraway, whose theorizations have been fundamental to the development of this work – lead to recognizing the fundamental equivalence between fermenting and rotting, differentiated only in the human experience. Therefore, fermentation has been further highlighted as a collaborative means to approach and tackle the matters of decay and death.

The last section of this work has been dedicated to the questioning of the individualistic and self-contained models of existence and to the reimagination of death in a collaborative and collective reality. Reimagination has been recognized as a generative, reality-making and sense-making force, as proposed by Tim Ingold. With these renewed understandings, the opportunity to conduct our human-form life actively pursuing and manifesting human and trans-specific forms of collaboration, while rejecting purity, has been recognized as the only possible vehicle for survival. Collaborative life explored through and sustained by fermentation has been brought forward by Monja Simon's research on sauerkraut making in the Black Forest and by the artistic example of Maroney and Nash;

as well as in the consideration of fungal life by Yasmine Ostendorf-Rodríguez and Anna Tsing's focus on matters of individuality and self-containment. From perspectives on the understanding of life, death has been taken into account an expression of the continuity recognized in collaborative and communal life, tackling matters of disgust proposed by Aurel Kolnai whose fear of fusion and confusion of beings and categories has been reframed as the only possibility of reality and therefore of survival, understood in a collaborative sense again through Tsing's understanding. The example of saprophyte fungi has been offered as a tangible expression of the endless continuity of life in collaboration, evidence of the blurriness of brings and categories within existence, which has been argued for throughout the work. Finally, fermentation has been proposed as a way for human beings to reimagine mortality and tackle grief by way of making-with microbial life – both from a practical and theoretical standpoint –, within the sticky reality of collaborative and collective existence. Examples offered by personal, relational experiences of dealing with mortality via fermentation have been a reminder of the evidence of these relationships as constitutive aspects of existence. Their account has been taken on without forgetting the disheartening and confusing reality of death, in an effort not to deny it but rather to reimagine mortality and tackle grief by way of human and trans-specific collaboration and community, which can find its expression in making-with microbial life through fermentation.

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