From flesh to insight: Constitutive more-than-human relations of care in a precision medicine pilot

ABSTRACT:

This paper delves into the constitutive more-than-human relations of care within the Micro-Dissected Tumor on a Chip (MDTC) experimental process, a precision medicine innovation that aims to derive predictions about a patient's response to chemotherapy by testing the drug on ex vivo samples of the individual's tumor. Contrary to the prevalent anthropocentric focus in the literature on laboratory work, this study explores the dynamic and performative interplay between human scientists and nonhuman entities, particularly tumors, in the generation of truth claims. Drawing on ethnographic methods, the investigation traces the trajectory of a tumor from its origin as human flesh to the culmination of an objective and actionable prediction. Through vignettes, the paper zooms in onto the affective, sensible and care dynamics within the scientific work that constitutes the MDTC experimental process. These findings are examined through a posthumanist lens to shed light on the performativity of care-driven more-than-human relations, challenging anthropocentric and cognitive views of scientific and organizational work.

KEYWORDS:

More-than-human relations; Affect; Sensible knowing; Care; Laboratory work.

1. INTRODUCTION

This investigation fits in a tradition of ethnographic work that explores how ordinary work drives the production of collectively accepted representations and truth claims. This tradition goes back to Latour and Woolgar's (1979) seminal work exploring laboratories as dynamic sites where objects and substances undergo a literary inscription process that culminates in scientific facts. This process is notably made possible by the endeavors of laboratory workers that act as brokers between the physical world and symbolic world of scientific knowledge. Through tasks such as preserving biological materials, handling instruments, running experiments, and documenting results, the specialized expertise involved in laboratory work plays a pivotal role in generating truth claims (Barley & Bechky, 1994).

Despite illuminating insights provided by the literature on laboratory work, a predominant focus on human agency has prevailed, emphasizing how material objects are transformed into objective representations by human agents. Consequently, this human-centric perspective obscures the active involvement of nonhuman entities, such as materials, substances, and instruments in the intricate process of truth claiming (Latour, 2005). In response to this problem, this study aims to provide answers to the following exploratory question: how do more-than-human relations co-create performativity in truth claiming?

To do so, this investigation traces more-than-human relations within Micro-Dissected Tumor on a Chip (MDTC) experimental process, a precision medicine initiative being developed and tested in a university hospital research center where I am actively engaged in fieldwork. MDTC is a precision medicine innovation that aims to derive accurate, actionable, and timely predictions about a patient's response to chemotherapy by testing the drug on ex vivo samples of the individual's

tumor. In the last decades, precision medicine – a healthcare approach that tailors medical decisions to the individual genetic, biological and/or environmental characteristics of each patient – and in particular precision oncology have gained traction within healthcare facilities around the world. However, such endeavors have faced what Polk et al. (2023) term as "the epistemic challenges of "doing" precision oncology […]" (p. 2). These organizational issues emerge from the reconfiguration of research and clinical processes for generating accurate and actionable health claims for individuals in a timely manner.

Within this framework, I track the trajectory of a tumor and the dynamic relations that unfold around and with it throughout the MDTC experimental process. By tracing its various in-practice instantiations (Mol, 2002), I delve into the transformative journey of the tumor, from its origin as a messy piece of human flesh to the culmination of an objective and actionable prediction. This endeavor is undertaken with the aim of illuminating the intricate epistemic challenges that the tumor contributes to raise and solve. This research therefore contributes to the exploration of more-than-human relations by transcending the dominant paradigms of anthropocentric and cognitive perspectives within the realms of scientific and organizational endeavors, such as precision medicine.

2. THEORETICAL BACKGROUND

To gain insights about the role of more-than-human relations in truth-making processes, we turn towards science and technology studies concerned with the laboratory practices that enable scientific production of knowledge. Extent studies consider laboratories as "reconfigurations of natural and social orders" (Knorr Cetina, 1999; p. 26) where nonhuman objects of investigation (e.g., materials and substances) undergo processes of metamorphosis that culminate into scientific

facts, and human subjects of investigations (e.g., scientists and lab workers) are enhanced into instruments of scientific knowledge production. Latour & Woolgar (1979) see in the laboratory a literary inscription process where specimens and substances are gradually (re)configured into measures, tables, documents, reports, which culminate into the scientific fact taking the form of published scientific paper. The literary inscription of natural phenomena are enabled by their displacement from the setting and time scale of their normal occurrence to the spatiotemporal regime of a laboratory; a movement that is made possible through the recasting of objects in their naturally occurring form into components, partial, or substitute versions of the whole (Knorr Cetina, 1999).

This (re)configuration process is notably made possible by the daily endeavors of laboratory workers that interact with objects of investigation through tasks such as manipulating and storing biological materials, handling instruments, running experiments, and documenting results. The specialized expertise involved in laboratory work plays a pivotal role in generating truth claims by acting as brokers between the material realm of specimens and substances, and the symbolic realm of scientific knowledge (Barley & Bechky, 1994). In fact, laboratories also (re)configure and enhance the social fabric they encompass, effectively harnessing human actors as tools for scientific endeavors: “Not only objects but also scientists are malleable with respect to a spectrum of behavioral possibilities. In the laboratory, scientists are methods of inquiry; they are part of a field's research strategy and a technical device in the production of knowledge." (Knorr Cetina, 1999 p.29). Within the setting of laboratories, both human and nonhuman entities are subject to (object of) reconfiguration: as humans and nonhuman interact with the laboratory, they form an ever-evolving socio(-)material machinery on which rests the possibility of scientific truth claiming.

Although this literature provides valuable insights about the role of laboratory settings, workers, and practice in the production of truth claims, it fails to address a notable blind spot: it offers a rationalistic and anthropocentric point of view of laboratory dynamics that obscures the consequential roles of specimens and substances in scientific truth claiming processes (Latour, 2005). The predominant focus on human agency that has prevailed in the current work emphasizes how nonhuman objects of investigation are manipulated and transformed into representations and truth claims through the procedural performances of scientists. However, a few exceptions in the STS literature stand out because of their focus on and around model animals within laboratories (REF). For instance, Lynch (1988) provides a powerful account of how "naturalistic" model organisms (e.g., rats) are superseded into "analytical" objects. Although the author illustrates how this configuration happens through a series of ritual and technical manipulations performed by human actors, he also argues that the nonhuman counterpart possesses a certain consequentiality in its metamorphosis as "the naturalistic animal provides the conditions for achieving its analytic counterpart" (p. 280). In this sense, Lynch suggests that scientists need to display a posture of empathy and attentiveness towards nonhuman model organisms in order to adequately configure them into analytic objects (see also Friese, 2013).

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Recent developments within the ontological turn in social studies driven by new materialisms (Coole & Frost, 2015), posthumanism (Braidotti, 2013), and agential realism (Barad, 2003, 2007;) have proven themselves insightful in their appreciation of nonhuman and matter's agentic capacities. These perspectives challenge conventional notions of stability and fixity of the material world, considering it instead in a constant state of liveliness and becoming (Coole & Frost, 2018). By underscoring the constant flux and interdependence of bodies and material entities, traditional

conceptions of agency are superseded through the notion of affect, highlighting the relational capacity of entities within more-than-human assemblages to affect and be affected. In this sense, agency is extended beyond human actors to encompass nonhuman entities' capacity to constantly assert potentialities in the ever-emerging flux of reality (Bell & Vachhani, 2020). These approaches reject dualist ontologies, viewing the cultural and natural, discursive and material, human and nonhuman, as intra-active, entangled, and inseparable facets of phenomena (Barad, 2007).

Building on these developments, laboratory work can be viewed as an array of sociomaterial practices where affect circulates and connects humans and more-than-humans into a truth-claiming machinery (Gherardi, 2017). Following Sage et al. (2020), scientists, instruments, model organisms, as well as other human and more-than-human entities involved in these affective relations, are conceived as "affective bodies", i.e., "organized conglomerate of matter an energy" that are definable by their present and future potentialities to affect and to be affected. Therefore, affective bodies and relations of the laboratory should be examined not for their inherent qualities, but rather the connections they form or encompass, their ability to influence their surroundings and to be influenced by it, as well as the outcomes arising from these dynamic exchanges (Fox & Alldread, 2017; Bell & Vachhani, 2020). Within this framework, the success of scientific endeavors starts from a recognition of the "fleshiness and fragility" of model organisms (Mol, 2006) and engaging with their intrinsic state of becoming (De la Bellacasa, 2011). A affective perspective therefore introduces a symmetrical and relational dynamic between humans and nonhumans entities involves in laboratory processes. It pays attention to sociomaterial practices that entangle human scientists and model organisms in enabling sensible and affective forms of knowing (Myers 2008).

In sum, this study follows the steps of Knorr Cetina's (1999) who went beyond the study of "the construction of knowledge" within the laboratories, and instead investigated their underlying epistemic cultures, i.e., the idiosyncratic machineries that enable truth-claiming within a laboratory. However, my investigation attempts to go one step further by exploring the role of affective relations in the process of knowledge production within laboratories, thus shedding light onto the more-than-human contributions on truth claiming.

3. METHODOLOGY

This ethnographic study is part of a research project that delves into the integration of precision medicine within a university hospital center in Canada. Part of this initiative consists in the development of Micro-Dissected Tumor Device (MDTD), an in-house innovation used to test chemotherapy on cancer patients' tumor *ex vivo* (i.e., outside the patient's body) before administering it to predict their response. MDTD leverages fluid mechanics and microfluidic devices to simulate an optimal environment for maintaining the viability and structure of micro-dissected tumors allowing scientists to test and analyze the effects of treatments. While this innovation is currently in pre-clinical research phase, the pilot involves live tumors donated by consenting patients undergoing tumor ablation surgery followed by chemotherapy treatments. The *ex vivo* tumor undergoes the same therapy as the patient to whom it belonged allowing scientists to compare experimental results with real-world patient's responses. Additionally, this pilot is also a platform for the cancer research laboratory to explore efficient organizing of the tumor-to-prediction trajectory.

Conducting the MDTD experiment involves an array of actors, instruments, as well as a research infrastructure that enables working with fresh human tissues. The tumor sample that undergoes the testing acts as the common thread throughout the experimental process: it serves as a model organism that simulates ex vivo the patient's cancer, i.e., the tumor that remain within the patient's body. This starts with enrolling the tumor sample in the MDTD experiment thanks to the research lab's biobanking infrastructure which was implemented over decades by the lab's primary investigator through relationship building with oncology surgeons and pathology departments. The biobank systematized the seeking of patients' consent to give their tissue and blood for research purposes, as well as the transportation securing of the specimens from the pathology labs and their transportation to the research labs. Once enrolled, the tumor calls for a series of interventions in the aim to sustain its fresh and alive state, which opens up the possibility of testing chemotherapy treatments on the tumor and to analyze its response. Throughout this process, the tumor participates in an array of practices in which it connects with scientists, microfluidic devices, and a multitude of other actors and objects. Through these more-than-human relational practices, the tumor affects and is affected through an asymmetrical process of *(re)configuration*; sometimes being *configured* by the agency of the scientists and their instruments, and other times imposing potentialities through its own actual sociomaterial *figures*.

This study adopts a posthumanist methodological strategy that aims to capture this affective process of (re)configuration and that puts in center stage the tumor and the performative more-than-human connections it performs throughout the MDTD experimental process. In this sense, to overcome the human-centered orientation of traditional ethnography, attention is shifted from human actions and interactions to performances by *agencements* of human (patients, scientists, technicians…) and nonhuman entities (bodies parts, instruments, substances…) that enact a certain

phenomenon such as the MDTD truth-claiming process. Thus, this strategy involves deploying data collection, data analysis, and theorization that enables the accounting for the multiple sociomaterial figures in which "the tumor" is instantiated within the MDTD experiment (Mol, 2002).

Ethnographic study began June 2023 and is ongoing. Data collection methods included shadowing of objects, semi-structured interviews and informal conversations, meeting observation, and documentary search. The main data collection strategy was to shadow the tumor in its navigation through the MDTD experiment in order to capture its emergent process of (re)configuration into a multitude of figures and their effects on their sociomaterial surroundings (Stewart, 2005; Bell & Vachhani, 2020). To shadow the tumor rather than human actors (Bruni, 2005) involves "letting it guide the researcher through the organization" as it confronts and connects with multiple other actors in various situations (Gherardi, 2019, p. 211). This involved tracing the tumor in its multiple forms as it is talked about, acquired, micro-dissected, treated, visualized, or analyzed; thus, as it is instantiated in various practices that drive the MDTC experimental system (Mol, 2002). From September 2023 to March 2023, I spent one to three days a week in a cancer research lab covering every step and procedure of the MDTD experimental process with a focus on the practices enacted with and around the tumor. Observations were notably recorded through the writing of fieldnotes complemented by photographic captures of key activities.

Shadowing of the tumor was complemented with semi-structured interviews with 15 informants as well as 15 interviews and organizational documents. Some interviews were conducted before the shadowing period and sought to gain contextual and background information about the MDTC innovation such as the history of its development, the key actors involved in its past and present

development, the pilot project that aims to evaluate the efficacy of the innovation, and the biobanking infrastructure that make it possible. Other interviews and informal conversations were conducted during and after the shadowing period with the aim to better comprehend the technical procedures and terminology, as well as to delve deeper into key affective episodes which aroused interest, interrogations, uncanniness, or excitement. For instance, when I witnessed a scientist's work being disturbed by a contamination in some of her devices, "killing" her tumors, I waited until the end of the day allowing the dust to settle to talk with her about how this situation affected her and the experiment.

Finally, documentary search through internal documents such as seminar presentations and project reports gave me access to some of the outcome that were generated from the MDTC experiments as well as the manner that scientist communicated their work to their peers. Similarly, external documents such as published scientific papers enabled me to better understand biochemical phenomena and technical procedures I witnessed.

The preliminary analysis approach (still ongoing) has revolved around tracking the activities involved in the trajectory of the tumor. Inspired by Langley (1999), the analysis first involved transforming messy raw material from a logbook into a descriptive chronological narrative, structured into ten phases. The narrative, which combines text and images, elucidates the MDTD experiment through its underlying performances. Although the described happenings involves various human and nonhuman actors, the narrative puts the tumor in center stage, illustrating activity that takes place with and around it, and the effects of this activity on the it's configuration. In fact, by organizing the narrative into phases, this narrative sensemaking aimed to discern temporary stabilizations of the tumor's configuration throughout the MDTD experimental process,

revealing how happenings in one phase brought into existence a specific configurations, and additionally, how a specific tumor sociomaterial figuration afforded or constrained towards certain activity patterns. The rationale behind bracketing the narrative into 10 phases was therefore a purely analytical move, enabling me to make sense of how a practice (or a texture of practice) within the MDTC trajectory performed constitutive effects on the tumor, stabilizing it into a temporary sociomaterial figure, marking the completion of an analytical phase, and setting the stage for the next.

Second, by navigating back and forth between the narrative and my raw field notes, I searched and identified specific episodes that had provoked feelings of surprise, shock, uncanniness, or unease within myself. I found these moments were situations involving scientists and tumor, where intense affective and/or sensorial states, such as excitement, frustration, passion, or astonishment, were made evident. To better make sense of these dynamics, I wrote vignettes as in-depth descriptions of these affective or sensible enactments that went in much greater detail than the chronological narrative. Through an iterative process of back and forth between vignettes and the literature on affect (Gherardi, 2017), sensible knowing (Strati, 2007), I inductively and iteratively derived posthumanist conceptual accounts about the scientist-tumor affective and sensible relations and their care-driven performativity on the MDTC truth claiming process (work in progress at the time of writing this version).

4. A CHRONOLOGY OF THE TUMOR-TO-PREDICTION TRAJECTORY (WORK IN PROGRESS)

This section expands the trajectory of a tumor in the MDTC experimental process detailing its involvement within nine routines and the multiple configurations it takes in relation to other actors0

Figure 1 illustrates the main routines that constitute the process and Annex A develops each routine through a textual and photographic account.

The account demonstrates the span of organizing that is deployed around the tumor in anticipation of producing a truth claim – in this case, being a prediction about a patient's response to chemotherapy. In fact, a tumor is a fleshy and fragile phenomenon that decays rapidly outside the human body. Moreover, the tumor is not analyzable in the form that it initially takes. Therefore, a lot of effort is deployed with the purpose of interessing and enrolling it within the MDTC experimental process, caring for it by catering to its need with the aim of maintaining it, and, finally, configuring it in ways to make it speak. Therefore, the narrative demonstrates how these practices in which the tumor is an actor have performative effects on the tumor and the array of other entities that are entangled within the MDTC agencement.

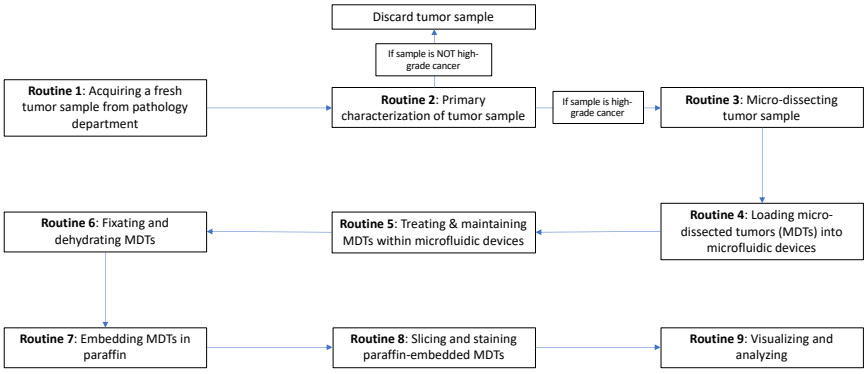

Figure 1: The 10 routines of the tumor-to-prediction trajectory within the MDTC experimental process

5. EPISODES OF PERFORMATIVE MORE-THAN-HUMAN RELATIONS IN MDTC

This section examines two vignettes, selected from the case, providing rich illustrations of care-driven more-than-human relations within the MDTC truth claiming process. The first vignette showcases the intense affective dynamics between a scientist and her MDTs as she attempts to care for them within routine 5 (treating and maintaining MDTs). The narrative demonstrates how this more-than-human affective enactment is performative as it generates situated knowledge and contributes to (re)configure the organization of the MDTC experimental process. The second vignette delves into sensible practices involving scientists, a tumor sample on a slide, and a microscope as they attempt to figure out whether the sample contains cancer cells within routine 2 (primary characterization of tumor sample). The account reveals how these more-than-human enactments tap into sensible and aesthetic forms of knowing to make crucial scientific decisions and thus contribute to (re)configuring the MDTC process.

5.1 VIGNETTE 1: THE FRUSTRATION OF CONTAMINATION

This morning I met Alyson in the lab at the usual time of 9:30 am. She tells me that today she is going to do a paraffin embedding on the devices that she fixated in formalin last week. As she opens the refrigerator where her devices are, she tells me that the other day, when she went to do the formalin fixation for her 120h time point MDTs, she found that they were all contaminated. "*The channels were all white*", she says with a deceived look. Fortunately, her loss was mitigated by the fact that these were "experimental" devices that she was testing at 120h, something she doesn't normally do.

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At around 12:30 pm, as Alyson is finishing the first half of the paraffin-embedding procedure, Pamela comes in the lab from her lunch break. They start talking:

Alyson: *I had my first contamination today! Luckily, it was my 120 hours tests. Almost all my channels were almost completely white.*

Pamela: *Are you sure it was contamination and not crystallized compound? Sometimes, a compound can crystallize and turn white...*

Alyson thinks for a moment: *Oops, I just assumed it must be contamination.*

Pamela: *Next time it happens, call me, and we'll look at it together.*

Alyson: *There was some in my control too, so it must be contamination. I assumed because the incubator's water was gross. At least it wasn't my regular experimental setups… It's still frustrating.*

Pamela: *When was the last time the incubator was cleaned?*

... [discussion on hypotheses about when the incubator was cleaned, who uses the incubator and the issues of having too many people using the same incubator.]

Pamela: *It can disturb the ambient air in the incubator when there's a lot of coming and going. Don't you have an incubator just for microfluidics?*

Alyson: *No, everything is mixed.*

Pamela: *That's not good... There used to be separate spaces. There should never be devices with treatments in an incubator that also contains Petri dishes... Treatments should be separated.*

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At the end of the day, we were talking, and I took the occasion to reraise the topic as it had attracted my attention, but I hadn't had the time to really discuss it. I asked her how she felt when she saw the contamination. She responds:

"*A first, I said "damn," and was disappointed, discouraged, as I had invested a lot of time and effort into these tests. The [tumor] samples are precious and require a significant amount of time and effort. Moreover, this loss sets back a portion of my research project. A time point is completely eliminated.*

Second, my rational side kicked in. I rationalized this loss by telling myself that it was an experimental time point she was testing to see if it would yield interesting results, and not a regular sample, which would have been much more damaging to lose. At least it doesn't ruin my experiments, but it would have been interesting to see the results.

Thirdly, my curious side took over. I went to the microscope to confirm that it was yeast contamination. I found it interesting to see these organisms under the microscope, which is not part of my usual work. It was an opportunity to engage my curiosity with something new, to derive pleasure from it, thus mitigating the disappointment of losing samples.
It's the kind of situation that can ruin a day."

She recounts a case in a previous lab where she lost an entire cell line that she was responsible for proliferating. It wasn't her fault; these things happen, but it still ruins a day. These are precious, irreplaceable samples. And it costs time and money.

5.2 VIGNETTE 2: A CASE OF PRIMARY CHARACTERIZATION (ROUTINE 2)

5.2.1 Case 1

Although I have yet to shadow the routine 9 involving the analysis of the tumor following the array of practices that configured it into visualizable-tumor-tissue-on-a-slide, some instances of what Bechky calls "questioning" is performed during routine 2. In fact, the process of primary characterization aims to ensure that a received tumor sample contains cancerous cells and is thus suitable to proceed with experiments. It consists in a series of procedures – e.g., flash freezing a small portion of the tumor sample, cutting slices of the frozen tumor tissue onto a microscope slide, staining the slide containing the tumor tissue with particular dyes to render specific tumor cell's components visible, and interpreting the slide under a microscope – that enables the scientists to decide whether the tumor sample contains cancerous cells or not.

As Stephanie observes the slide of tumor tissue under the microscope, she is looking somewhat puzzled: "No idea what this is... I'll have to ask for help," she says. As she cannot make a clear decision, she decides to go back up to the lab with the slides to consult her colleagues. In the lab, we find Alyson, Mathieu, and Pamela. Stephanie explains her confusion about the cells she sees on the slide: "I can't distinguish the parts..."

Alyson answers, "I'm curious, show me." They place the slide in the microscope. Alyson looks at it for a moment. "I understand what you mean."

Stephanie: "You see! There are no weird structures!" Alyson continues to observe the cells, adjusts the slide to see other sections of the tissue. "This is odd."

Pamela, curious, approaches. Alyson makes spaces for her to look into the microscope, but she is also struck by the oddity of this tumor. It's not clear for the three of them.

Mathieu, who was until then busy with another task at another microscope is now curious too. He heads towards the microscope and looks through it for a few seconds.

"Hmmm... I'm inclined to say yes... we see that the cells have an atypical architecture..."

Then, after a few seconds more of observation, "In my opinion, we take it...," keeping his eyes in the microscope, "yes, I think we take it..." then a few seconds later, still looking at the slide: "it's clearly for us! To me, it's clear: it's high-grade! It's invasive!"

The more Mathieu looks at the sample, the more convinced he becomes.

Excitement fills the room. As Stephanie, Alyson, and Pamela hear Mathieu's increasing certainty of the presence of cancer in the sample, they seem more and more pleased and excited. "So, let's do it!" says Fanny, talking about launch the process of punching MDTs and loading devices (routine 3 and 4).

5.2.2 Case 2

Once the staining is finished for the first slide, Stephanie hands it to Alyson, who places the sample under the microscope. She observes for a few seconds.

Alyson: *It's beautiful...* (with an astonished tone)

Stephanie: *It's beautiful?*

Alyson: *Yes!*

Alyson continues to observe the sample as she moves the slide to see another section of the tumor.

Alyson: *Oh yeah, I think both are good.* [2 seconds] *Wow!*

Stephanie: [discreet laugh]

Alyson turns to me: *Do you want to see?*

I approach and peer into the microscope, seeing various pink spots arranged in patterns but with curved spaces separating different clusters of pink spots.

I ask Sabrina: *What am I supposed to see?*

Alyson: *You see cells forming...* [with her finger, she traces the shape of waves]

Me: *Waves?*

Alyson: *Yes. When cells form wave-like structures, it indicates high-grade serous.*

Me: *Where am I supposed to see these waves…?*

Alyson: *If you follow the cell lines, it creates waves.*

For me, it's all but obvious. I don't see the waves she is seeing.

Alyson to Stephanie: *I'll tell them [the rest of the team] it's good, so they can start punching.*

Stephanie has finished her staining. She goes to the microscope to view the cells.

Stephanie: *Wow!* [3 seconds] *It's so beautiful.*

Alyson: *It's beautiful, huh?*

Stephanie: *So beautiful. Perfect, very good news for us! But not for the patient...* (she says the last part somewhat muffled).

They pack everything up to head to the microfluidics lab to begin the punching process. Stephanie meets Giselle in the lab while preparing to leave.

Giselle: *And the tumor?*

Stephanie: *Very beautiful! Superb! There was plenty of epithelium!*

6. PRELIMINARY DISCUSSION (WORK IN PROGRESS)

The vignettes showcase the complex landscape scientists navigate in the face of the fragility and fleshiness of the material they work with. The findings shed light on the affective and sensible dimensions of more-than-human care relations challenging the anthropocentric and rationalistic view of truth claiming.

The first vignette demonstrates how nonhuman actors hold the potential to "affect" scientific work and its organization. The tumor, instantiated in the "contaminated devices", provoked negative affects (disappointment, frustration) within the scientist, which prompted a reflection about what went wrong and discussions between colleagues about changing practices to prevent this type of situation. In other words, the affective relation enacted in this situation enabled learning about the "good" and "bad" ways to undertake the MDTC process, therefore affording and constraining opportunities for reconfiguring of the said process (e.g., cleanliness and division of incubator space). By accounting how affects connect the scientist to the tumor, we see how scientific work is constituted by more-than-human relations (Gherardi, 2017). These findings highlight what Sage et al. (2020) term "the significant interplay of joyful and sad affects in the survival of bodies" (p.

360). In fact, the survival of the tumor as much as the scientific endeavor are shaped by their relational capacity to develop positive affects and limit negative ones. This is notably achieved by relationally transforming each other into specific configurations, allowing connections with certain entities (microfluidics devices, nutrient solutions) while limiting connections with others (fungi).

The second vignette illustrates the sensible and aesthetic dynamics between scientists and a tumor, suggesting that truth claiming goes beyond the realm of human cognitivism and rationalism. The assessing of whether a tumor sample contains cancer is a situated negotiation performed by an agencement involving scientists, instruments such as a microscope, and the tumor. This configuration allows the scientists to become one with the tumor through the microscope – to become an embodied medium through which "cancer" can become communicatively constituted (Cooren, 2020). The enactment of this communicative constitution of a truth claim is a matter of more-than-human sensible knowing (Strati, 2007). In fact, recognizing the wave-like cellular structures of cancer requires what Strati (2007) terms "taste-based judgement" the relational ability to sensibly know something as "beautiful" or "ugly". As this entanglement unfolds, the sensible scientist is afforded the ability to act as the tumor's spokesperson, ventriloquizing the presence or absence of cancer (Nathues et al. 2020).

Finally, both vignettes shed light on the care-driven nature of more-than-human relations involved in the truth claiming process. Affective and sensible knowing hinges on a care posture within the scientist-tumor relation. To be affected by an "other", to be moved to the point of becoming its spokesperson, one must initially care about it. This means to be willing to direct concern and attention towards this "other" whether human or not (Martin et al., 2013). This understanding is achievable through establishing connections, engaging affectively and sensibly, and rejecting

objectification (De la Bellacasa, 2011). Consequently, framing more-than-human relations as care-driven balances the power dynamics between human and nonhuman entities. While the human side may appear "responsible" for the nonhuman, as stated by De la Bellacasa (2011), “Taking responsibility for what and whom we care for doesn’t mean being in charge.” (p. 98). Instead, it involves embracing "response-ability”, defined as “the capacity and willingness to be moved, in both the affective and kinesthetic senses of the verb ‘to move’” (Martin et al., 2013, p. 11).

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ANNEX A: A PHOTOGRAPHIC CHRONOLOGY OF THE TUMOR-TO-PREDICTION TRAJECTORY IN THE MDTC EXPERIMENTAL SETUP

ROUTINE 1) TUMOR SAMPLE ACQUISITION:

The MDCT experimental system is dependent on the provision of fresh and living tumor specimens (photo 1). Making tumors available for MDCT therefore requires considerable coordination between the biobank and the surgical team. This starts by first anticipating the tumor by weekly reviewing schedules of upcoming gynecological surgeries and consulting with the microfluidics team to identify candidate cases for MDTC. A few days before surgery, during a preparation consultation, a clinical team member asks the patient to sign the biobank's consent form for giving tissue and fluid specimens for research purposes. The day of a scheduled ovarian tumor removal surgery, a biobank worker coordinates with the pathology lab (where human tissue and fluids are taken during surgery for examination) to anticipate the tumor's arrival. At the pathology lab, she deploys persuasive measures to obtain a small sample of the tumor specimen. In fact, the tumor is a precious resource for both the pathology lab (diagnostic aims) and biobank (research aims), although the former has priority over it. Usually, if the tumor is big enough, the pathology lab is willing to share a "nice" sample. If quantities are scarce, then the biobank obtains a small sample, sometimes composed of less valuable portions of the tumor tissue.

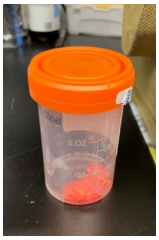

Photo 1: A tumor sample acquired from the pathology department

ROUTINE 2) PRIMARY CHARACTERIZATION:

When the MDTC candidate tumor enters the biobank, it is imbued with uncertainty about its composition. Although the pathologist makes a diagnosis for the entire tumor sample, uncertainty remains about the sample the biobank has acquired. Since the biobank may sometimes obtain the "scraps" from the pathology lab, it is necessary to perform primary characterization to ensure that the sample contains cancer cells and is suitable for further experiments. A primary characterization consists in a series of lab procedures that lead to interpreting a slide of the sample's cells (photo 2) under a microscope enabling the scientists to decide whether the tumor sample contains cancerous cells or not (photo 3).

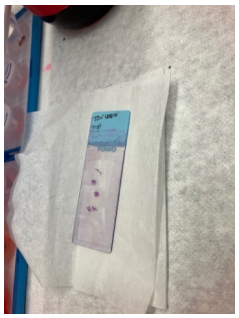

Photo 2: A slide containing a tumor slice

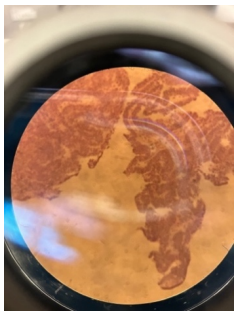

Photo 3: A tumor slice under the microscope

ROUTINE 3) MICRO-DISSECTING TUMOR SAMPLES:

If the tumor sample contains cancer, it enters the MDTC experimental system of which the first step is to "punch the MDTs" (photo 4), i.e., puncturing the tumor tissue using the tip of a syringe to cut out micro-dissected tumors (MDTs) which are dropped in a saline solution (photo 5).

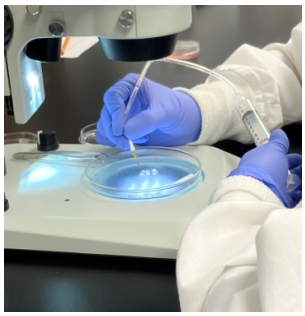

Photo 4: A scientist punching MDTs

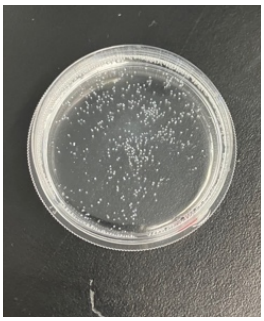

Photo 5: MDTs in a saline solution

ROUTINE 4) LOADING MDTS INTO MICROFLUIDIC DEVICES:

The MDTs are loaded into microfluidic devices, malleable chips that contain four channels, each with an inlet and an outlet from which fluids can be injected and extracted. At the bottom of each channel are eight square wells that trap the MDTs (photo 6). To load the MDTs, eight at a time are

sucked into a pipette with their saline medium and injected through an inlet into the channels of a device (photo 7). Through a suction mechanism performed with the pipette, the scientist can carefully "push and pull" the MDTs through the channels to cause them to fall into the wells, a meticulous task reminiscent of the ball maze toy. Photos x and x show the channels of a device before and after the injection of MDTs (the MDTs appear as small dots in the channels in the second picture). Routines 3 and 4 must be performed in the hours following tumor receipt to keep the tumor alive and fresh.

Photo 6: The microfluidics devices used in this experimentation

Photo 7: A scientist loading MDTs in a device

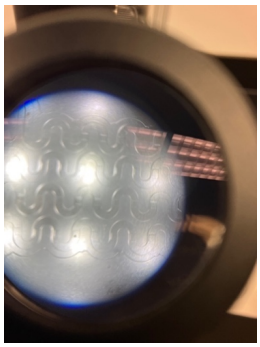

Photo 8: A microfluidics device under the microscope before loading

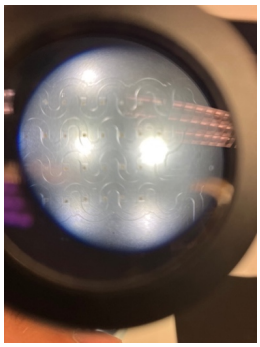

Photo 9: A microfluidics device under the microscope after loading (MDTs appear a grey dots in the channels)

ROUTINE 5) TREATING MTDS WITH THERAPY SOLUTION:

Once the MDTs are loaded into the microfluidic devices, they are treated by injecting into the devices a mixture of medium (containing nutrients that preserve the MDTs) and different treatment solutions (usually one set of control devices + several sets of different therapies or different concentrations of the same therapy) (photo 10). The MDTs are kept in treatment for several time periods.

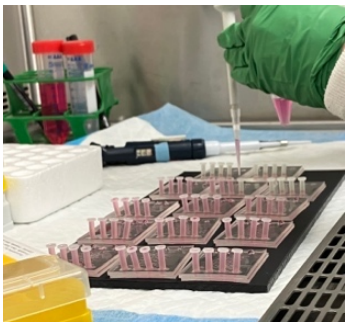

Photo 10: A scientist loading devices containing MDTs with a chemotherapy and nutrient solution

ROUTINE 6) FORMALIN FIXATION AND DEHYDRATING MDTS:

After the specific period of treatment, the MDTs are fixed in formalin, which stops their development, preserves their cellular architecture and prevents their degradation. It is a critical step for observing and characterizing MDTs at specific time points. Formalin fixation is performed by injecting a formalin solution into the channels of the devices, immersing the MDTs in the liquid (photo 11). Once fixation is complete, the devices are injected with increasing concentrations of ethanol, which dehydrates the MDTs.

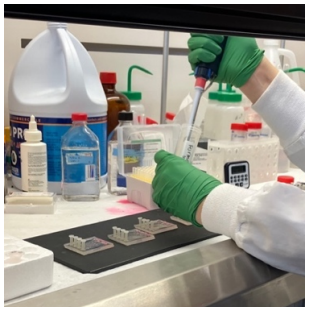

Photo 11: A scientist loading devices containing MDTs with a formalin solution for fixation

ROUTINE 7) EMBEDDING MDTS IN PARAFFIN:

MDTs are embedded in a paraffin block, which allows them to be preserved and stored for extended periods of time. The devices are opened to expose the channels containing the MDTs, then placed in a mold filled with heated paraffin and left to cool for the paraffin to harden (photo 12).

Photo 12: MDTs embedded in paraffin for preservation (visible as pink dots in the righthand bloc)

ROUTINE 8) SLICING AND STAINING PARAFFIN-EMBEDDED MDTS:

In preparation for the visualisation and analysis of MDTs, paraffin blocks containing MDTs are sliced into 4 micrometers (µm) cuts that are placed on microscope slides (photo 13). The slides containing 4µm MDT slices are then stained with specific dyes that color specific cellular components rendering visible under a microscope (photo 14).

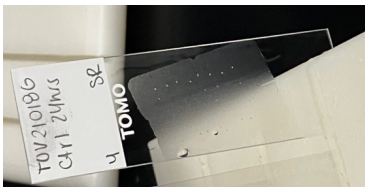

Photo 13: Slide containing a slice of paraffin-embedded MDTs (visible as white dots)

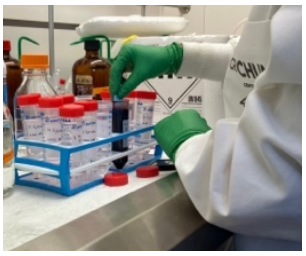

Photo 14: A scientist staining slides containing MDTs

ROUTINE 9) VISUALIZING AND ANALYZING:

Finally, the slides containing 4µm slices of MDT are put under the microscope for observation and interpretation in order to analyze the effects of the treatment on the tumoral cells (I have not yet shadowed this performance as of writing this paper, but will be done in the coming weeks).