



**Northumbria  
University**  
NEWCASTLE

# *Of Lace and Living Things*

*A Curated Portfolio*

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## *Prologue:*

*Dear reader, dear material, dear self,*

This portfolio is a love letter to the journey we have shared.

A year where curiosity took precedence, where new learnings unfolded in ways I could never have anticipated. A year where hands, mind, and material worked in quiet dialogue, where patience was not a demand but a gift, where tenderness became method, material and meaning.

To my materials - you surprised me at every chance. You were delicate yet defiant, soft but stubborn, and you never once let me forget you were alive in your own way. You demanded such care but returned more beauty than I knew possible. You taught me that imperfection is not failure, but personality. Together we negotiated possibility.

To myself - thank you for trusting your intuition. For recognising that design is not simply a process of problem-solving but an act of feeling, of sensing, of becoming. This project has taught me that intuition is not a flimsy justification, but a powerful guide - as legitimate a reason as any to make and choose.

To you, the reader - this book is not simply documentation, it is a tactile record of growth. It is a reminder that making is more than output: it is a relationship. I hope you feel the intimacy here - not just of lace and material, but of thought, attention and care.

I have never felt so aligned with my work. This project has felt like home: an encapsulation of so many parts of me, woven together in fibres both literal and metaphorical. It has replaced hesitation with pride, overthinking with joy, and fear with the kind of quiet confidence that comes from truly knowing what matters.

This portfolio invites you into that space - of curiosity, of care, of craft - and I hope you can't help but linger.

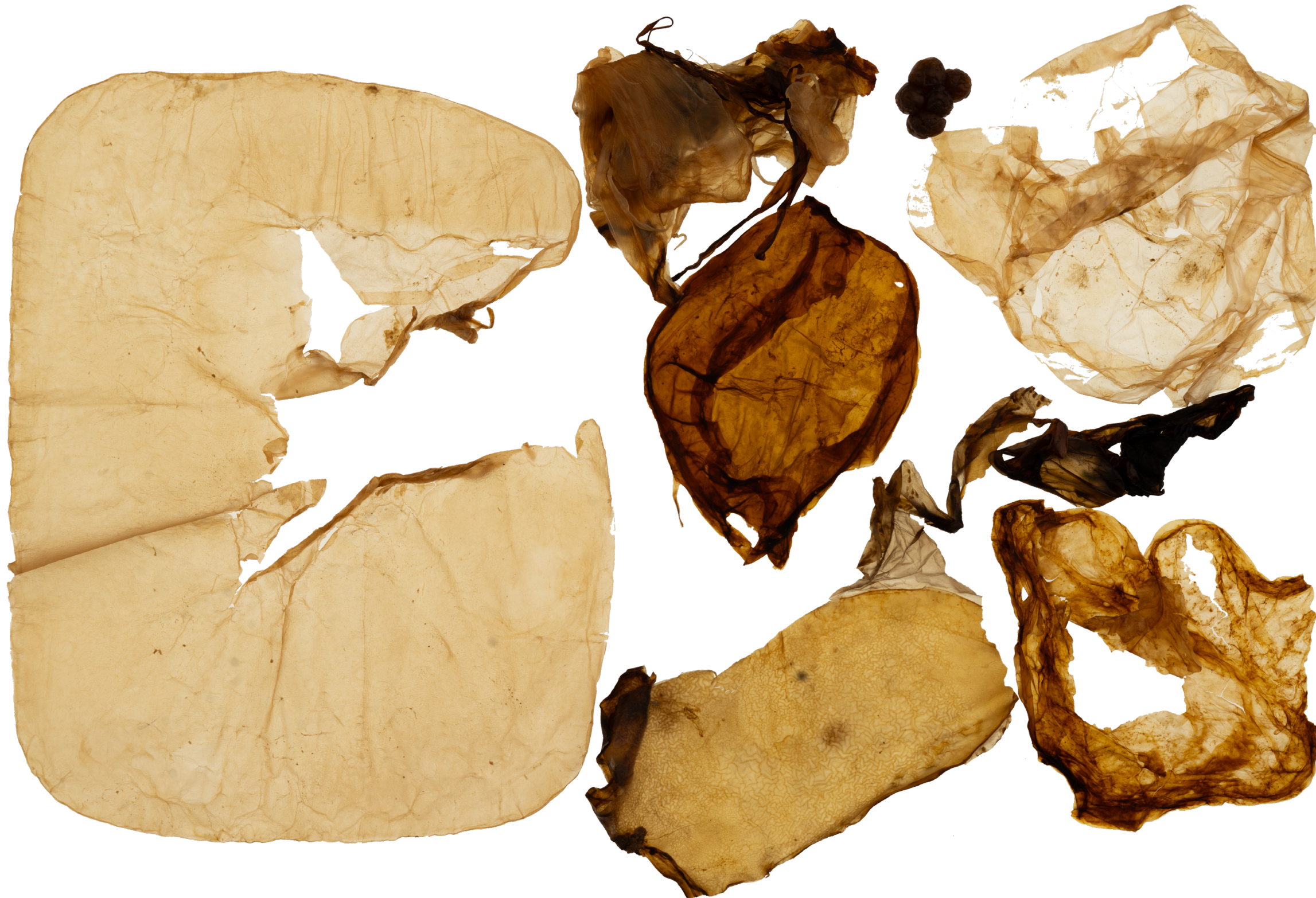
Tenderly,  
Elise



This project began as an exploration of how lace - historically luxurious and unique - might be reimagined through living material. Working primarily with bacterial cellulose, I set out to craft embellishments that hold memory in their very surface.

But this was never simply an exercise in materiality. The work unfolded across many strands: technical experimentation, pattern cutting, creative prototyping, exhibition-making, and gathering reflections from viewers and potential wearers. Rather than treating biomaterials as novelty or mere sustainable substitute, this project has been about discovering their character - their responsiveness, unpredictability, and the stories they invite.

Here, lace becomes more than ornament. It becomes material storytelling: a space where tradition and innovation meet in fibre, form, and feeling.









*How can biomaterials be developed as emotionally resonant, materially viable textiles for contemporary lingerie, and what design strategies enable their integration into sustainable fashion systems?*







# *Negotiated Process*

## *A Methodology of Making*

This project followed a practice-based methodology, where process itself became inquiry. Rather than applying theory at a distance, making was used as a way of thinking - hands-on, iterative, and critically reflective.

Working with bacterial cellulose demanded an approach that was responsive and cyclical: planning, acting, observing, and reflecting at every stage. This aligned with principles of Action Research, enabling material behaviour to shape design decisions in real time.

Success here was understood as plural and provisional: some experiments failed, others revealed unexpected beauty. Throughout, intuition and sensitivity acted as valid tools for inquiry, allowing the work to unfold as a dialogue between material and maker.

In this way, methodology was not an abstract scaffold but an active, embodied practice - evolving in tandem with the material itself.





## *The Unravel: What Didn't Work (and Why That Matters)*

Some ideas didn't last - not because they lacked promise, but because the process pulled me elsewhere.

Root systems were explored early on: fine, fibrous, and rich with potential. But without soil, root posed a new challenge to guide shape. Trials were slow, outbalanced, and stuck in the mud.

Some bacterial cellulose samples succumbed to mould during storage or growth - reminders of the material's living nature and the constant need for care. Others faltered in longevity: too humid, and they softened; too dry, and they became brittle. A few were lost altogether.

Replication, too, was never exact. No two batches behaved the same, and attempts to reproduce outcomes became lessons in letting go of uniformity.

These moments - though quiet - shaped the direction of the work. They refined my focus, reminded me to pay closer attention, and taught me that in working with living materials, constraint is not failure. It's information.









# Threads of Research

*“Bio-lace must evoke familiar qualities of intimacy while introducing an unfamiliar material logic - aided by new narratives around sustainability, material behaviour, and emotional connection.”*

- *Elise Waters (Thesis Section 4)*

This project was guided by a constellation of ideas that wove together material experimentation with critical discourse. Central among these was Kate Raworth’s Doughnut Economics, which framed sustainability not as constraint but as a design opportunity - thriving within boundaries. This lens encouraged me to approach biomaterial cultivation as an act of balance: meeting human needs for touch, sensuality and intimacy while respecting ecological limits.

The Five Dimensions of Sustainable Design (Kozlowski et al., 2019) provided an expanded ethical compass, reminding me that sustainability is multidimensional:

Environmental: Working with low-impact, regenerative materials

Social: Exploring community trust and sensory intimacy

Cultural: Honouring lace’s lineage as intimate, decorative, symbolic

Economic: Imagining decentralised, craft-led innovation

Aesthetic: Reframing desirability through tactility, translucency, and imperfection

Throughout, I was drawn to notions of emotional durability: the idea that sustainability depends not only on responsible materials but on creating deep, lasting relationships between wearer and garment. This encouraged me to think about how materiality, tactility and narrative could extend care into the life of an object.

Critically, this project adopted a material-led design approach, where experimentation itself was methodology. Following Fuad-Luke’s principle that “experimenting is a form of inquiry”, my process was deliberately iterative, flexible, and receptive - a negotiation between designer, material, and environment.

These theoretical threads formed a quiet but constant framework, underpinning decisions and ensuring that this project was as critically reflective as it was creatively expressive.









## *Where Accidents Mend*

This work was never about control - it was about attention.

In cultivating bacterial cellulose, the process itself refused to follow neat plans: surfaces wrinkled, threads formed unexpectedly, films cracked at their own will. What might have been called mistakes elsewhere became turning points here - sites of negotiation rather than correction.

To mend invisibly is not to hide.

It is to integrate: not to smooth over the unexpected but to weave it into the logic of the whole. This project sought to fold new material behaviours into familiar forms - lace/embellishment - without erasing their difference.

Accidents were not obstacles; they were opportunities for refinement, discovery and dialogue. The experiments wove themselves together through these accidents, allowing the material's character to assert itself at every stage.

A stencil that bled dye unexpectedly suggested new lace patterning; a dried crack became a natural seam; a frayed edge invited reinterpretation as thread.

These moments of unpredictability did not threaten the project's coherence - they defined it. Each outcome emerged not from total control but from careful attention to what the material revealed.

In this way, the invisible mend became both metaphor and method:



*an approach that welcomes imperfection, integrates surprise, and acknowledges that transformation happens from within -not through imposition, but through attunement.*











# Growing Lace, Not Making It: A Recipe

## Why lace?

*I've always loved lace - its delicacy, symbolism, and emotional power. But traditional lace trims pose challenges for circularity.*

*I wondered: What if we didn't make lace... what if we grew it? Could something soft, detailed and intimate be born from living material, not machinery?*

### Ingredients:

- Black tea, sugar, water
- SCOBY (Symbiotic Culture of Bacteria and Yeast)
- Glycerol
- Time, care, patience



### Method:

#### 1. Grow your base bio-film:

Brew a sweet tea, add the SCOBY. Cover loosely so it can breathe and leave for 14 days.

A fine beige pellicle - your bacterial cellulose - will slowly form on the surface.

#### 2. Glycerol rinse (think: skin care):

Immediately after lifting out of the tea, rinse gently in a 40% glycerol solution.

This moisturising ritual prevents cracking, adds softness, and makes the material far easier to handle.

Soaking = bad (it disintegrates); rinsing works best.

This step should be standard practice for all bio-lace samples.

#### 3. Stencil and pattern:

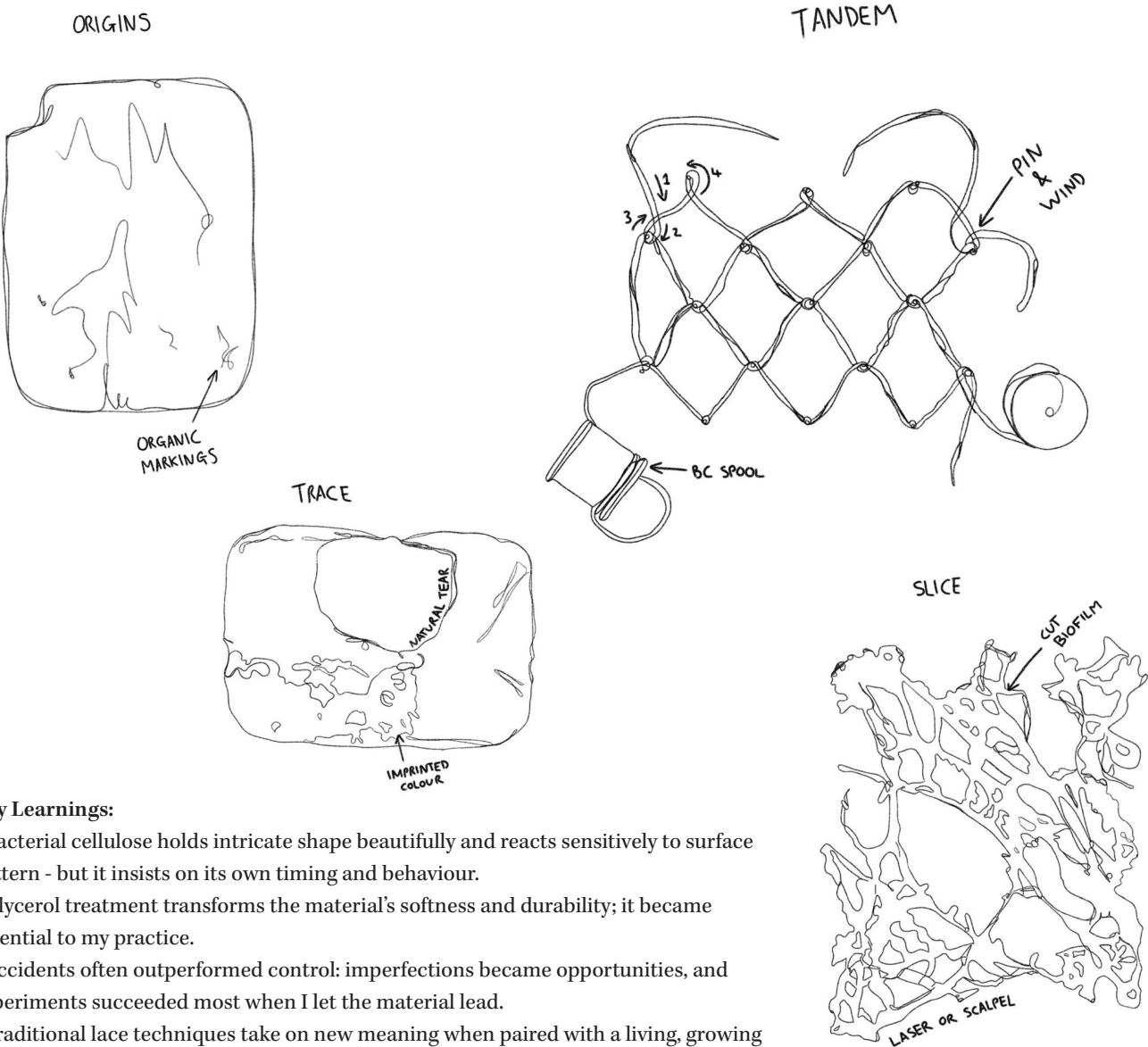
Lay lace samples or laser-cut stencils onto the wet surface. The SCOBY responds instinctively to these interruptions - forming around them and even absorbing their colour if dyed. Be patient - drying can take several days to weeks.

#### 4. Thread discovery (a happy accident):

Threads form naturally around stencil edges as the SCOBY works around the interference.

These thread-like structures resemble yarns and can be twisted or pinned mid-dry.

They twist, tangle and gather - offering surprising potential for bobbin lace techniques.



### Key Learnings:

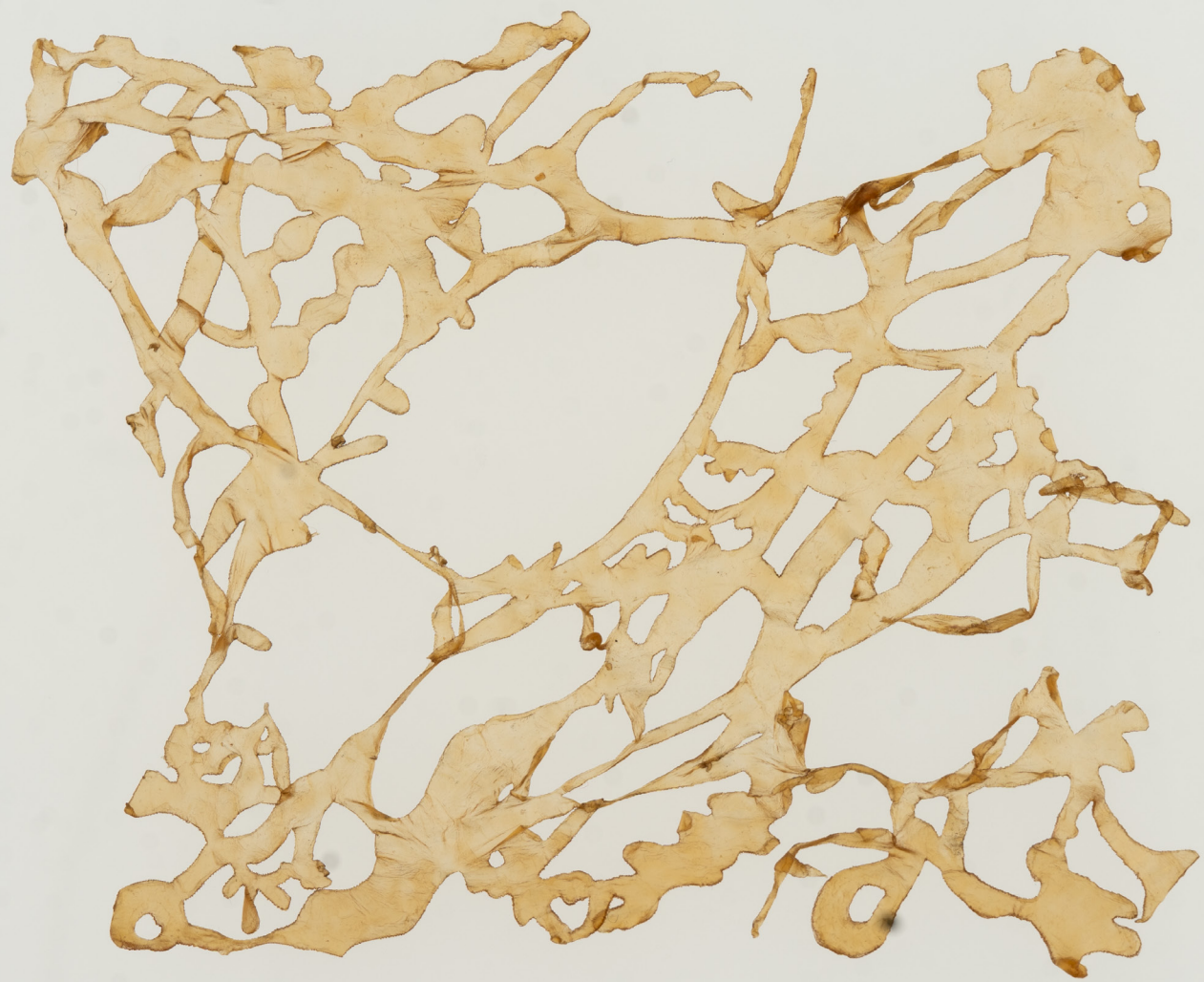
- Bacterial cellulose holds intricate shape beautifully and reacts sensitively to surface pattern - but it insists on its own timing and behaviour.
- Glycerol treatment transforms the material's softness and durability; it became essential to my practice.
- Accidents often outperformed control: imperfections became opportunities, and experiments succeeded most when I let the material lead.
- Traditional lace techniques take on new meaning when paired with a living, growing substrate. This relationship felt like a genuine collaboration - not fabrication.

### What I'd tell another maker:

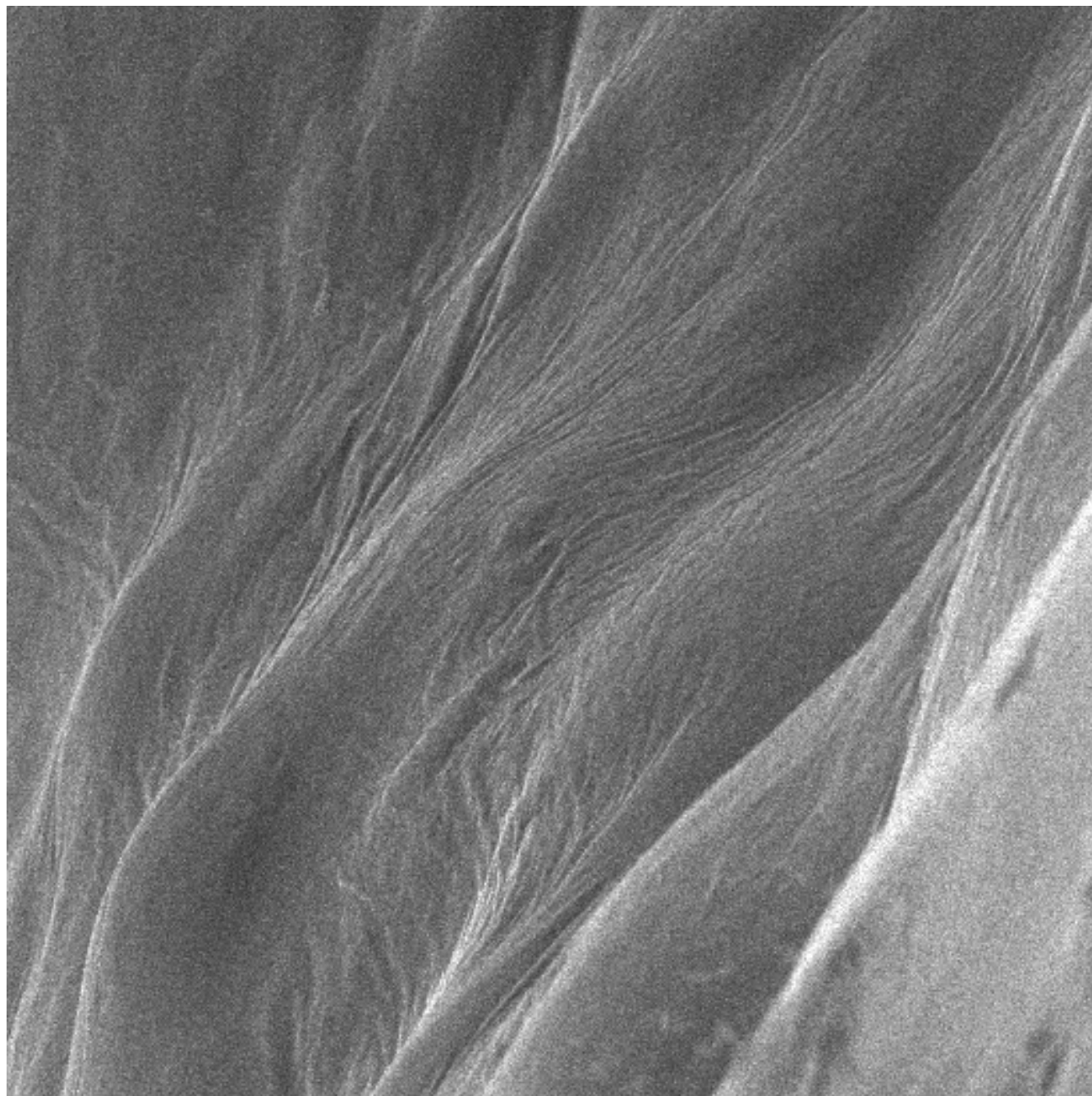
Don't try to control it - collaborate with it.

The best results come when you let bacterial cellulose show you what it wants to be.

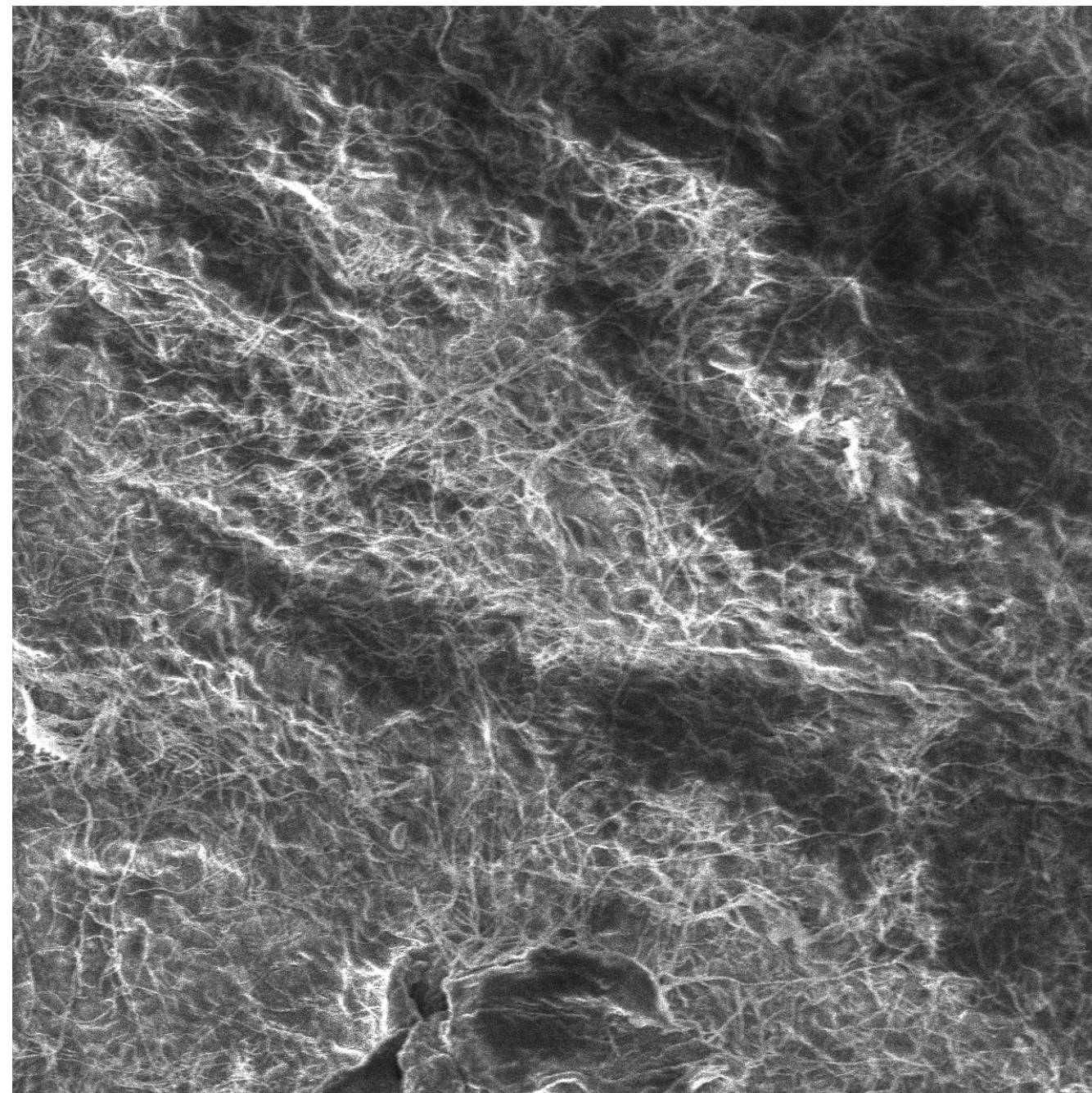









SEM HV: 5.0 kV	WD: 20.22 mm	 10 $\mu$ m	MIRA3 TESCAN
View field: 45.1 $\mu$ m	SEM MAG: 2.60 kx		
Det: SE	Date(m/d/y): 05/23/25		



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## *Material Within / Material Without*

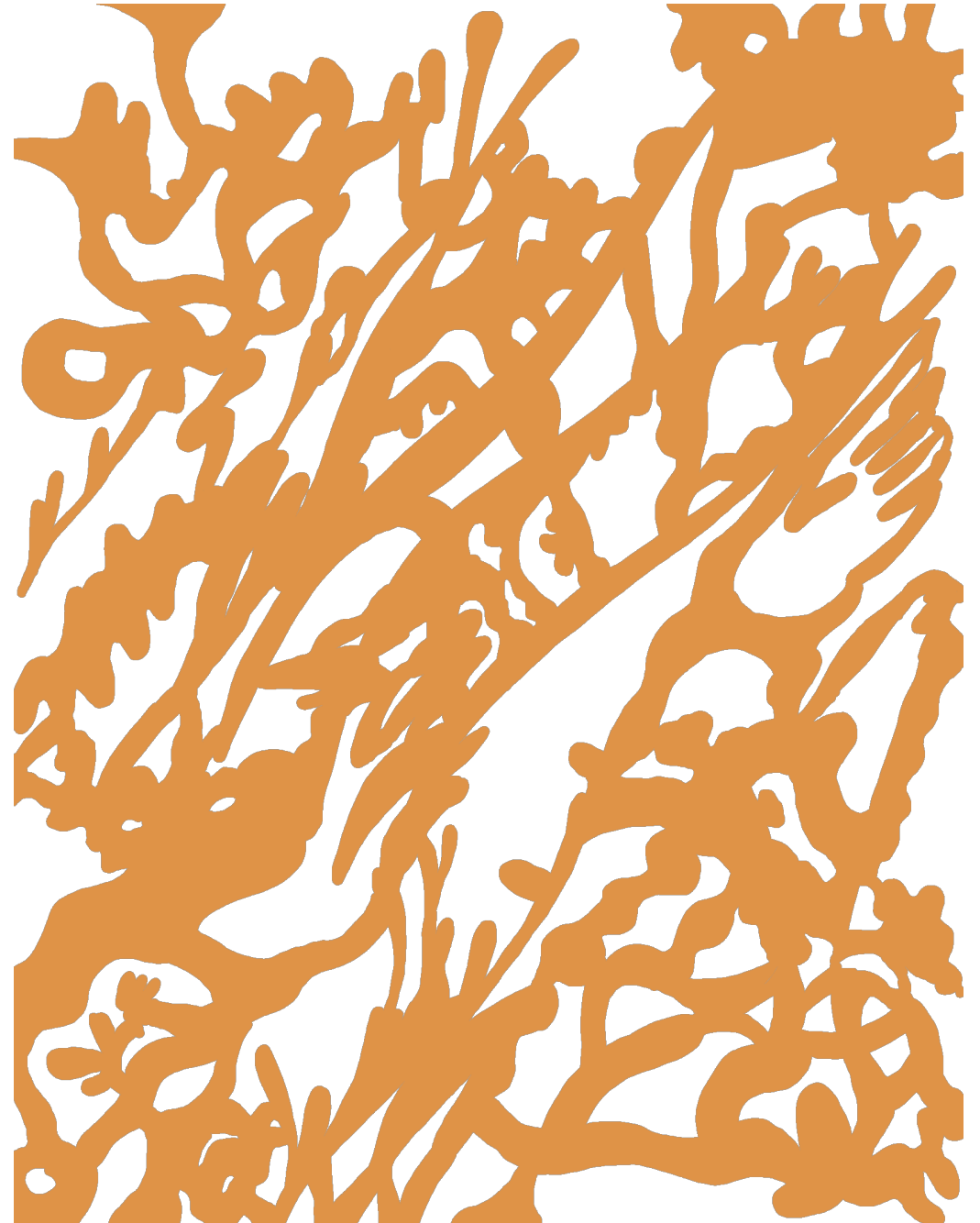
At a certain point, making turned to listening.

The bacterial cellulose - unpredictable and delicate - began to suggest its own vocabulary. Wrinkles weren't flaws, but filaments of character. Surface tension wrote its own motifs.

Through the scanning electron microscope, I didn't just observe the material - I collaborated with it. The SEM revealed that the bacterial cellulose already bore lace-like structures at a microscopic level: fibrous, branching, interlaced.

What began as a search for embellishment became something else - a quiet proposal from the material itself.

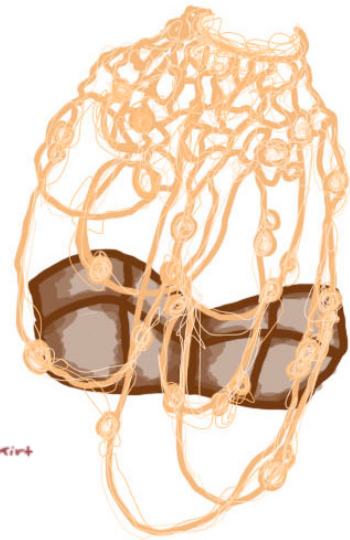
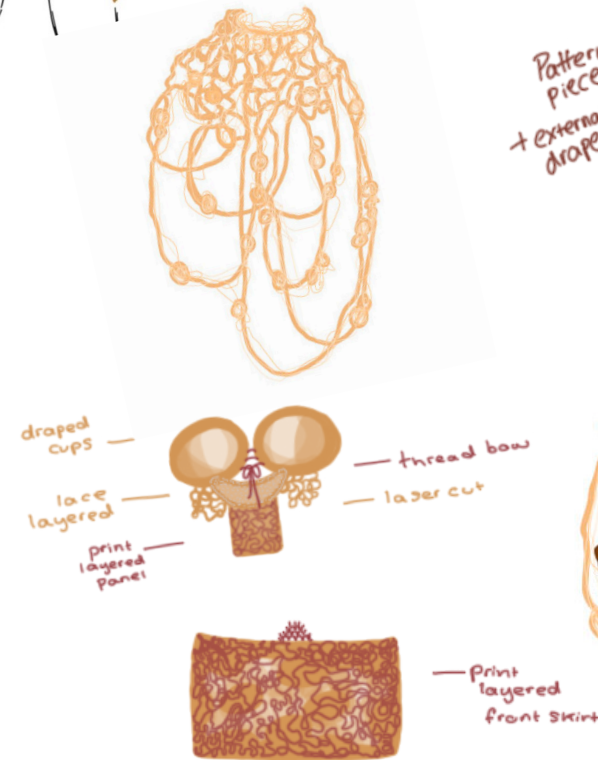
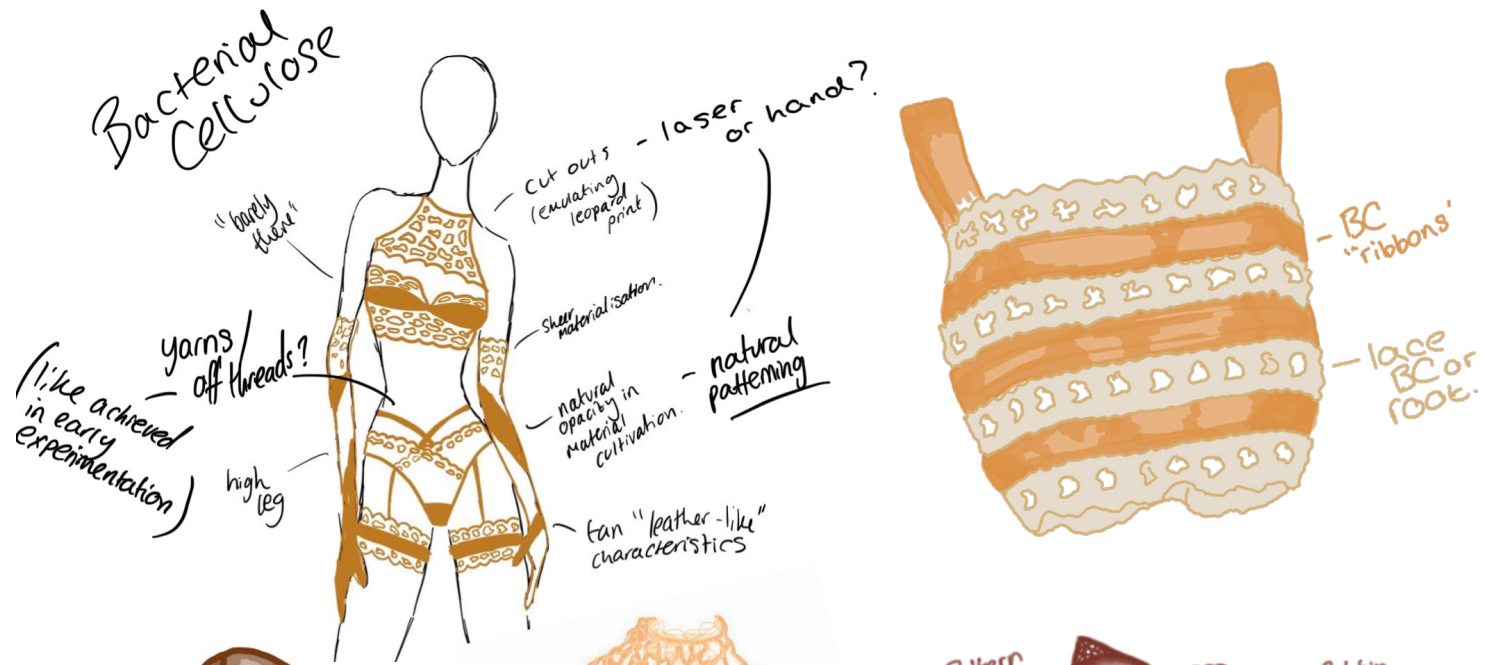
*I wasn't adding lace to the cellulose. I was drawing it out.*











These sketches are not blueprints, but responses - drawn not from trend forecasts, but from the materials themselves. Each curve and cut was guided by the bio-lace's behaviours: its tightening as it dries, the way it holds tension, the delicacy of its faults. The silhouettes reflect not only what the material is, but what it asks for - pieces designed to sit close to the skin, to echo its softness, its hold, its breath.





## *Ode to the Cultured*

You culture patience,  
a slip of skin spun slow -  
tight at the seam,  
soft in the swell.

You form yourself around me,  
knotting where I'd smooth,  
fraying at my edges,  
binding me gently back to care.

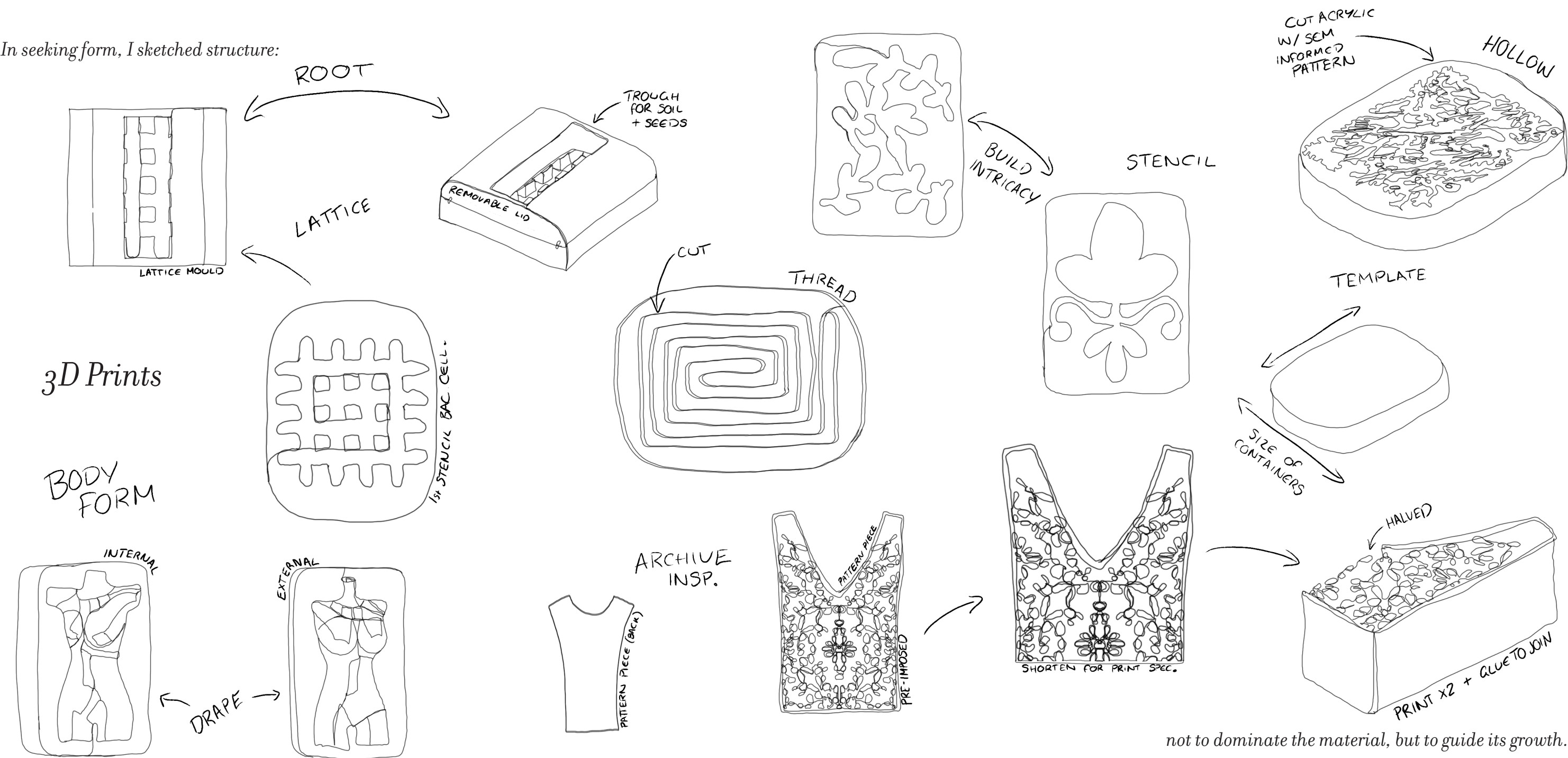
You lace time itself:  
A warp of days,  
a weft of breath,  
woven not by hand but by hunger.

In your cling and curl,  
you craft resilience -  
thin, puckered, perfect  
in your refusal to obey.

You are not made.  
You are grown.  
And in your tangle,  
I learned to mend.



In seeking form, I sketched structure:



not to dominate the material, but to guide its growth.



## *Care Guide for Bio-Lace*

**This material was not made.**

**It was grown - imperfect, alive, tender.**

**To care for it is to accept its moods:**

Handle gently: fibres stretch and pull; scars and creases are part of its story.

Keep dry: excess moisture may encourage it to bloom again (not always where you want it to).

Store softly: fold loosely, allow air to circulate - like lace in a cedar-lined drawer.

Accept imperfection: cracks and puckers are gestures of character, not flaws.

Do not rush: this material prefers time.

*Remember:*

*Bio-Lace carries memory.*

*Its marks are evidence of your care, its fragility an invitation to tenderness.*













*Stitched with who I've become. Not an ending, but a trace.*