Sofía Guridi

Sustainable Smart Textiles: Challenges and biomaterial opportunities

Smart Textiles

Textiles capable of controlled interaction with the environment

Incorporating technologies from different disciplines besides textiles

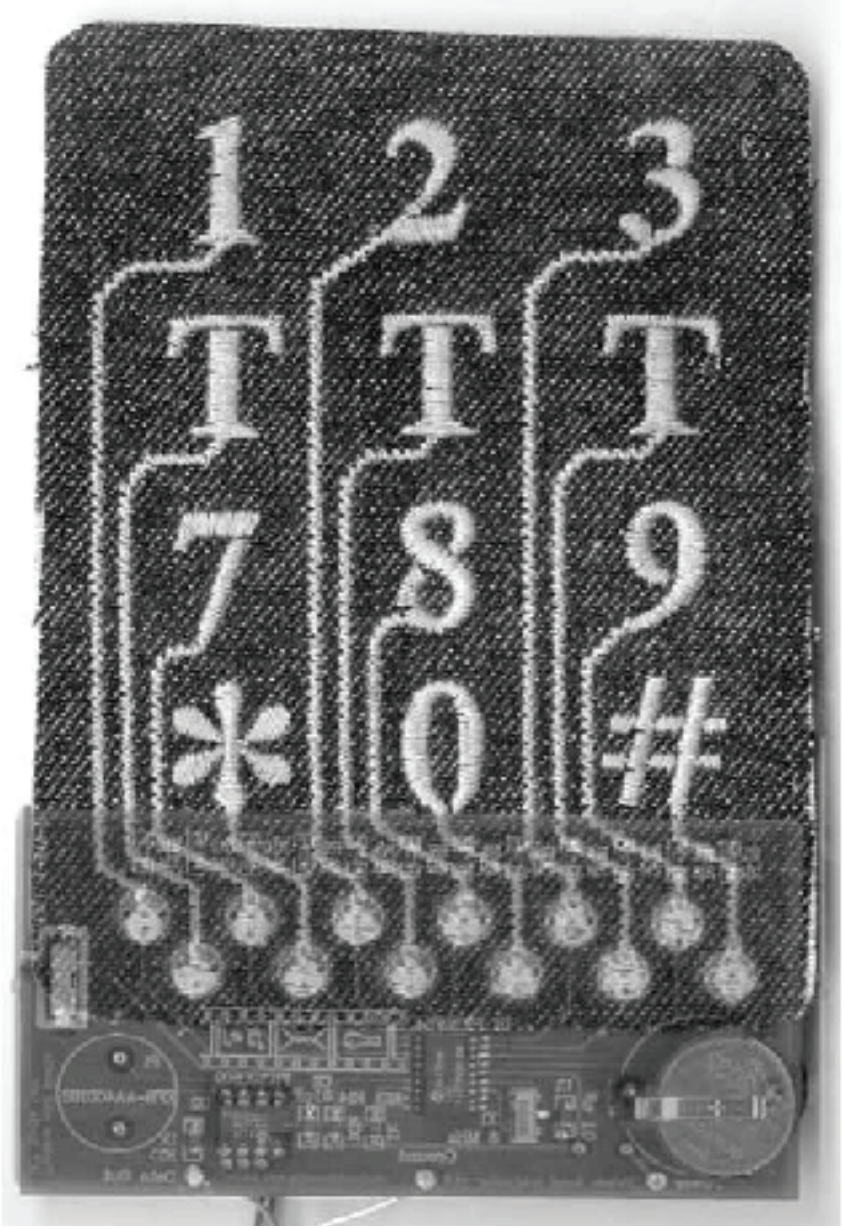
Adding many functionalities: Aesthetical, social, comfort, performance, monitoring, actuation, etc

BioLogic, MIT, 2015

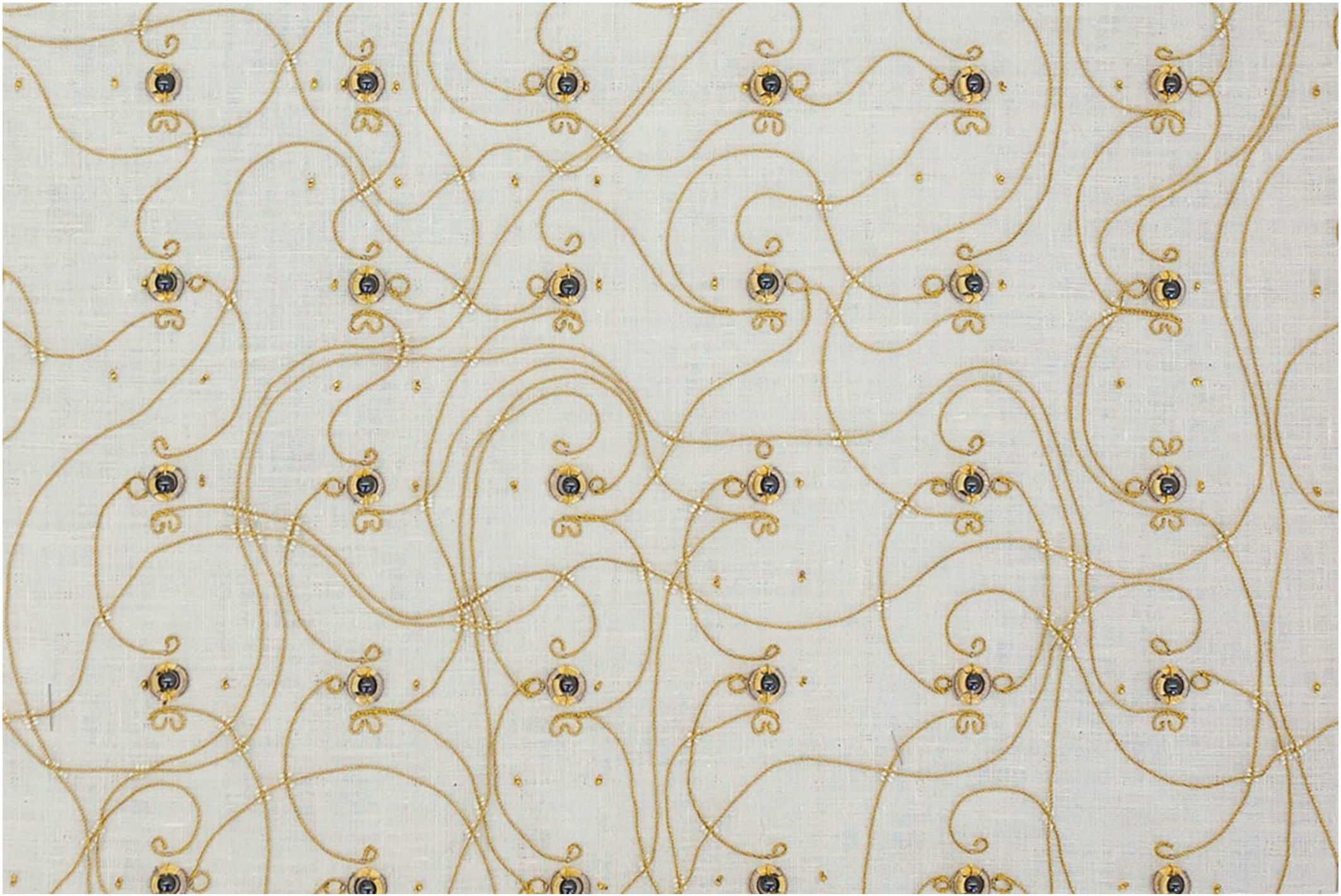
Electronic Textiles *eTextiles*

* Subset of **smart textiles**
* Also referred to as ‘wearable electronics’
* Analogue and digital **electronic components** are (more or less) seamlessly integrated **into/onto** textile structures
* Obtain, store and process **data**
* Soft and flexible electronic products enable novel user experiences
* Uses in:
  Healthcare
  Sports
  Performance arts
  Training
  Robotics
  Fashion
  etc..

Electric Dress, Atsuko Tanaka, 1967



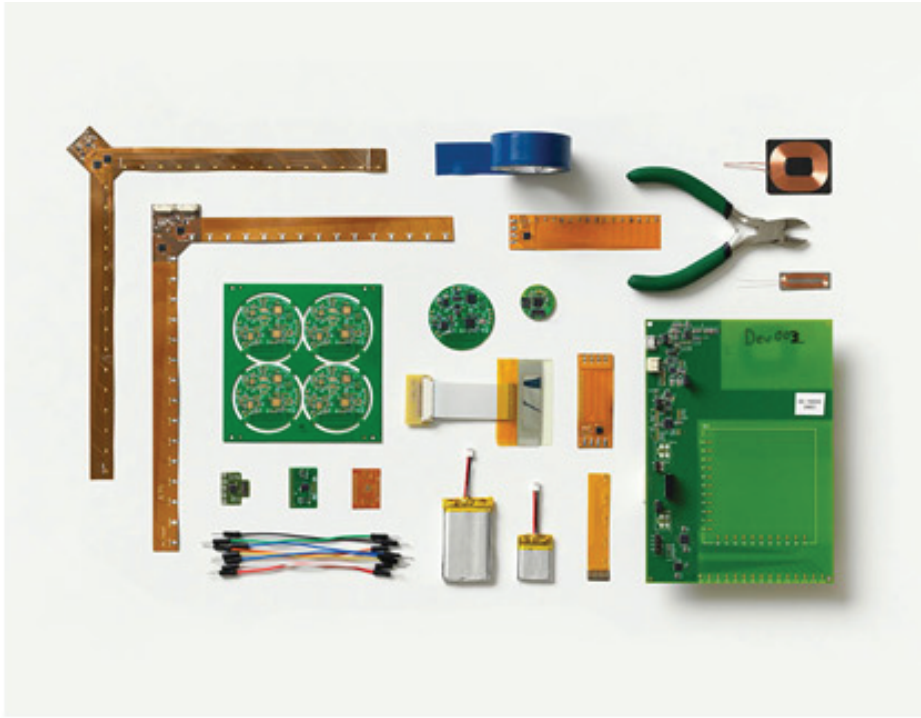
Smart Textiles, Rehmi Post and Maggie Orth, 1997



The Embroidered Computer, Ebru Kurbak and Irene Posch, 2018

Hugsy, Sylvie Clae, 2017

Amor Muñoz Expanded Bodies, 2022

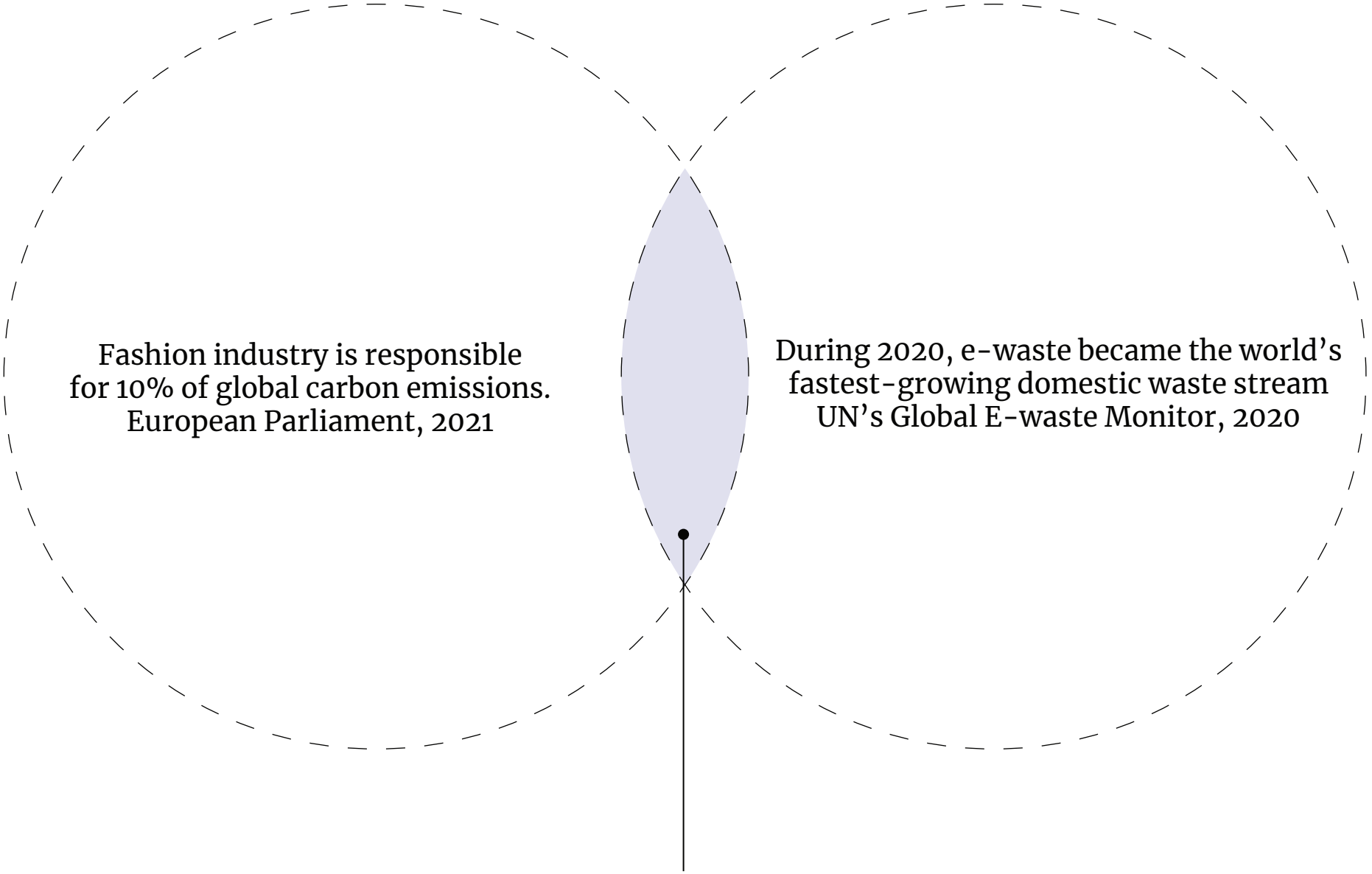


Google Levi's, Jacquard project

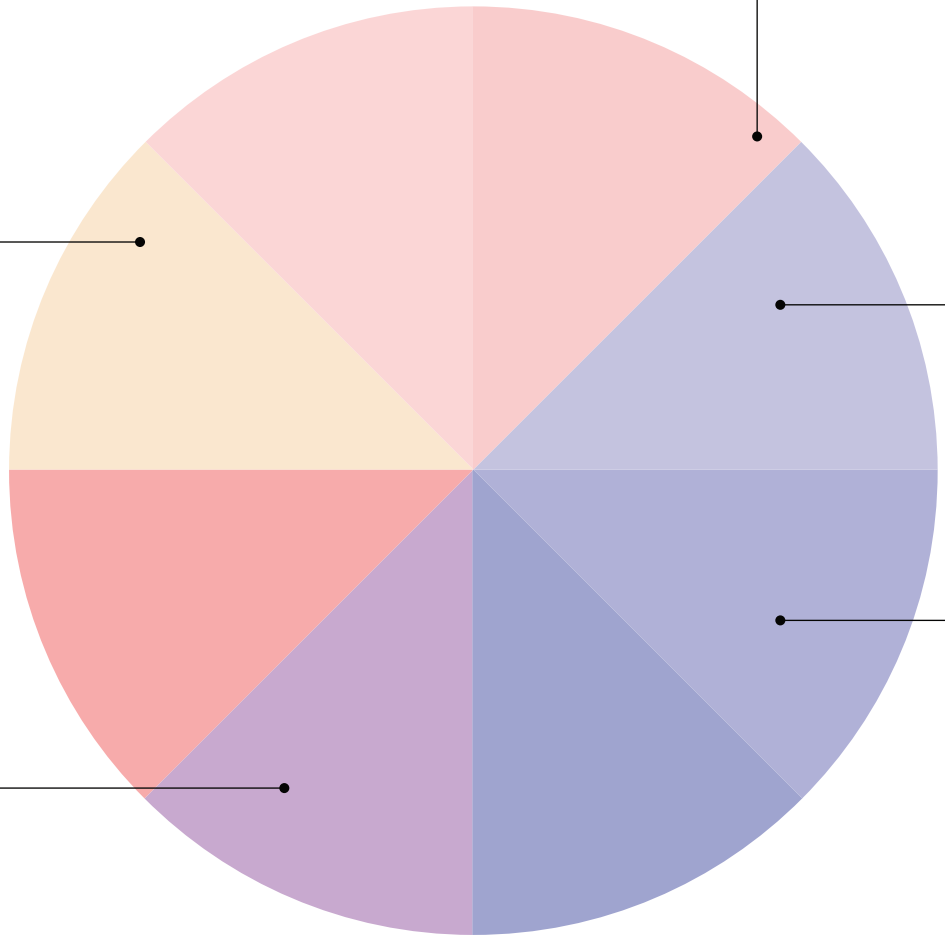
Aura, Clara Daguin, 2018


DURACELL

Challenge


Fashion industry is responsible for 10% of global carbon emissions. European Parliament, 2021
During 2020, e-waste became the world's fastest-growing domestic waste stream UN's Global E-waste Monitor, 2020
Need to work on strategies for environmentally conscious design of eTextiles

Challenge



MATERIAL ACQUISITION
- Use of ecologically friendly materials
- Renewable sources

DESIGN AND DEVELOPMENT
- Minimizing comsuption
- Purposeful products

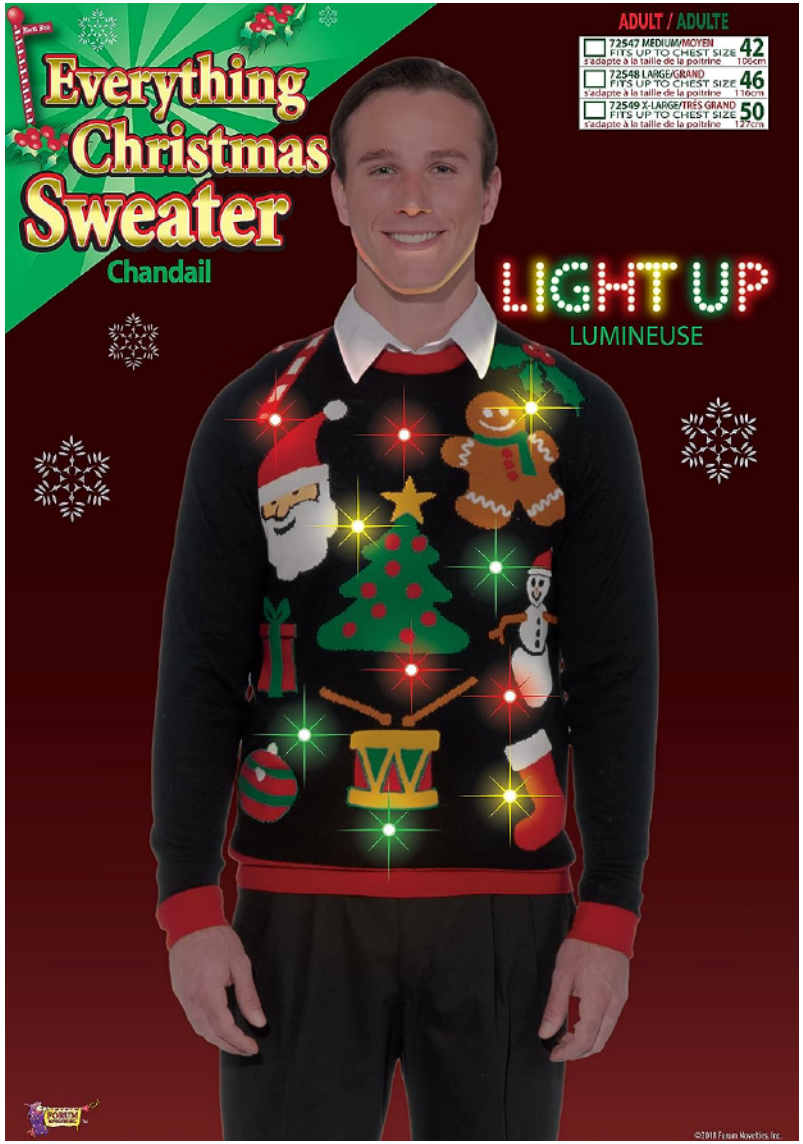
MANUFACTURING
- Sustainable manufacturing methods

END-OF-LIFE TREATMENT AND DISPOSAL
- Dissasembly
- Labelling
- Compatibility standars
- Waste prevention
- Degradable materials
- Recyclable materials

USE
- Service systems
- Longevity of materials
- Longevity of products
- Reuse
- Repair
- Refurbishment

Eco-Design and Life Cycle Thinking
ISO 14006', 2020

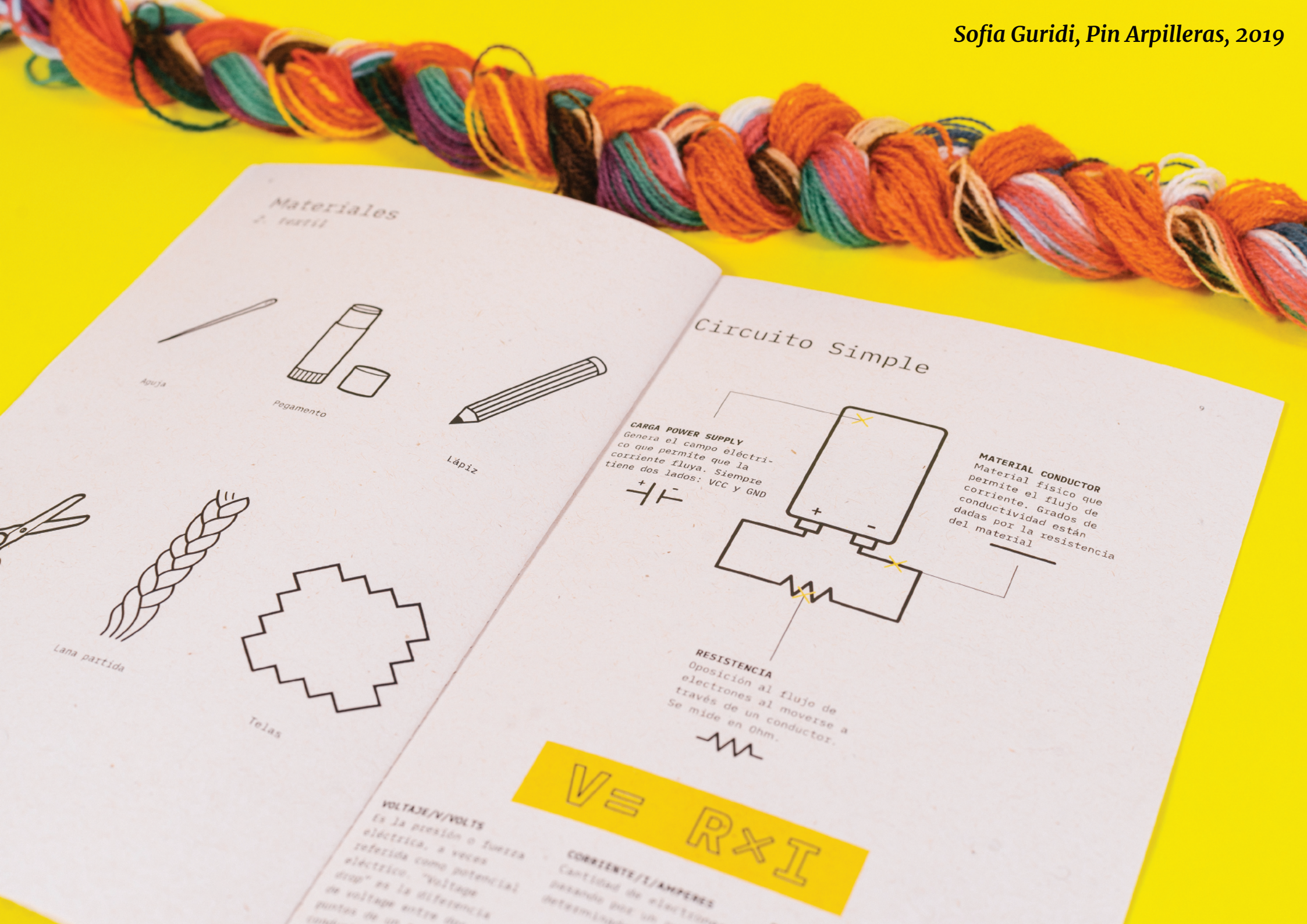
DESIGN AND DEVELOPMENT


Everything Christmas Sweater
Chandail
ADULT / ADULTE
72547 MEDIUM/MOYEN 42
FITS UP TO CHEST SIZE
s'adapte à la taille de la poitrine 106cm
72548 LARGE/GRAND 46
FITS UP TO CHEST SIZE
s'adapte à la taille de la poitrine 116cm
72549 X-LARGE/TRÈS GRAND 50
FITS UP TO CHEST SIZE
s'adapte à la taille de la poitrine 127cm
LIGHT UP
LUMINEUSE

smart?

Arpilleras

Sofia Guridi, Pin Arpilleras, 2019




Sofia Guridi, Pin Arpilleras, 2019

Sofia Guridi, Pin Arpilleras, 2019

Amor Muñoz, Yuca_tech, 2015

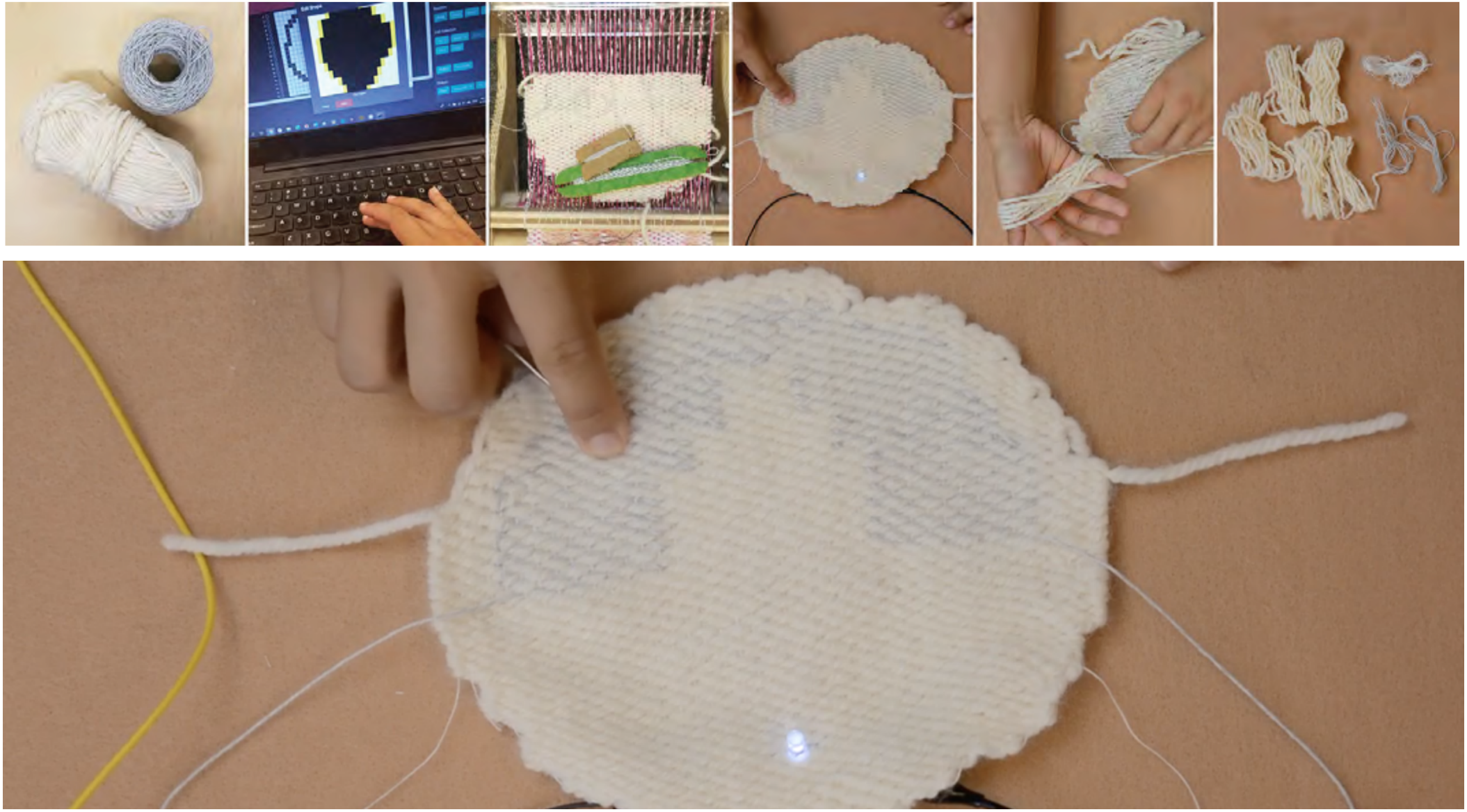
USE

Ramyah Gowrishankar, Engaging with e-static textiles, 2020

Aalto University, Sun Powered Textiles, 2021

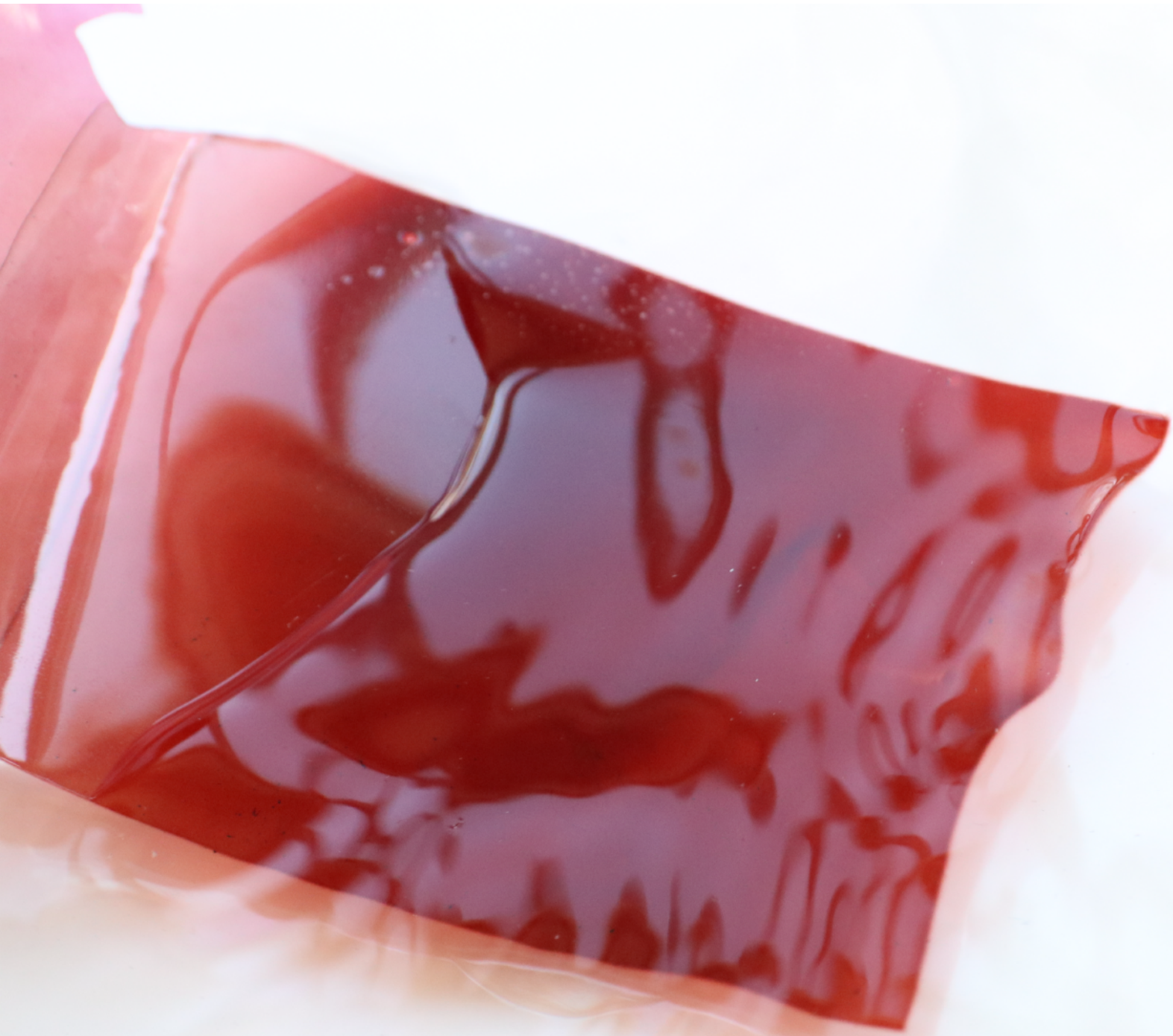
Kristi Kuusk, Crafting sustainable smart textiles services, 2016

END-OF-LIFE TREATMENT AND DISPOSAL



Shanel Wu and Laura Devendorf, UnFabricate, 2022

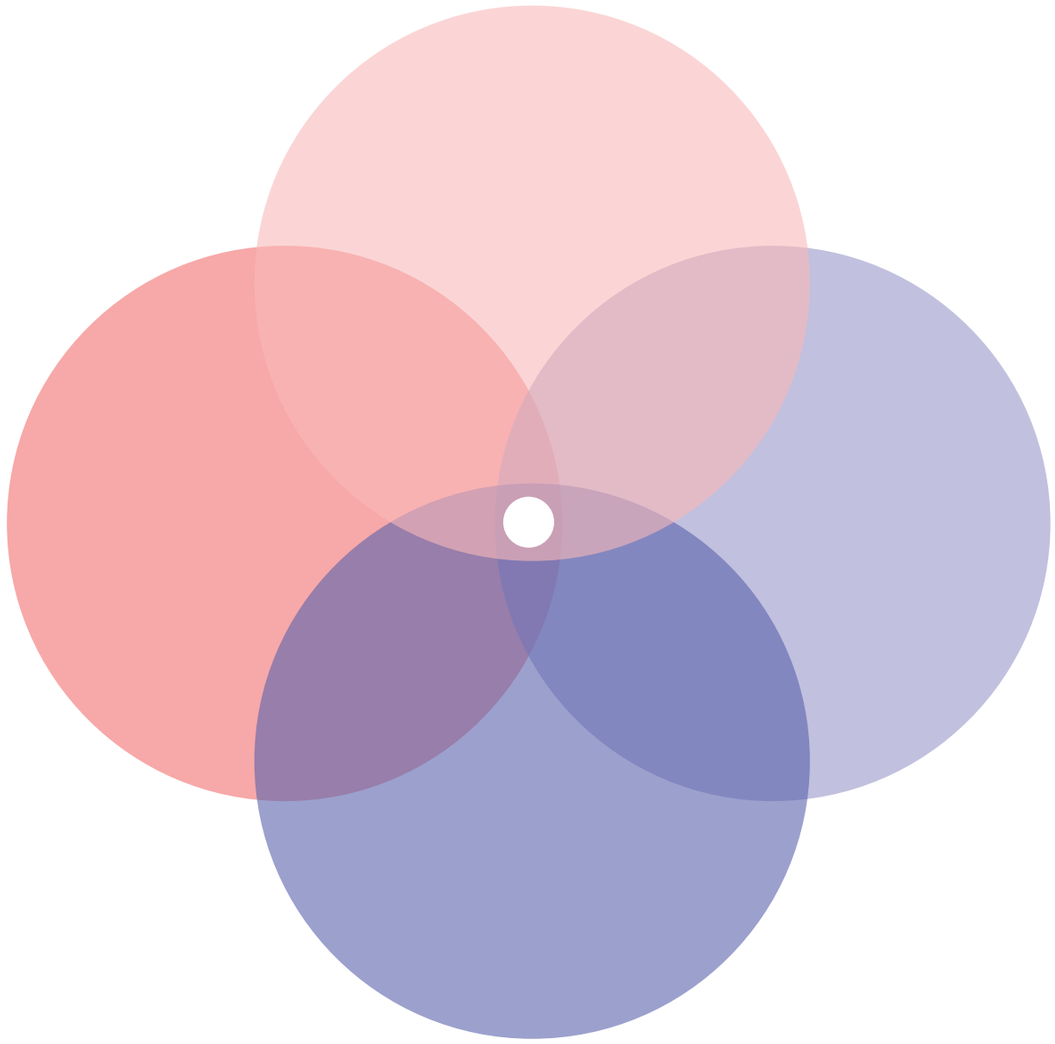
MATERIAL ACQUISITION



Biomaterials

+ *Renewable sources*
+ *Biodegradable*

TEXTILES



MATERIAL SCIENCE

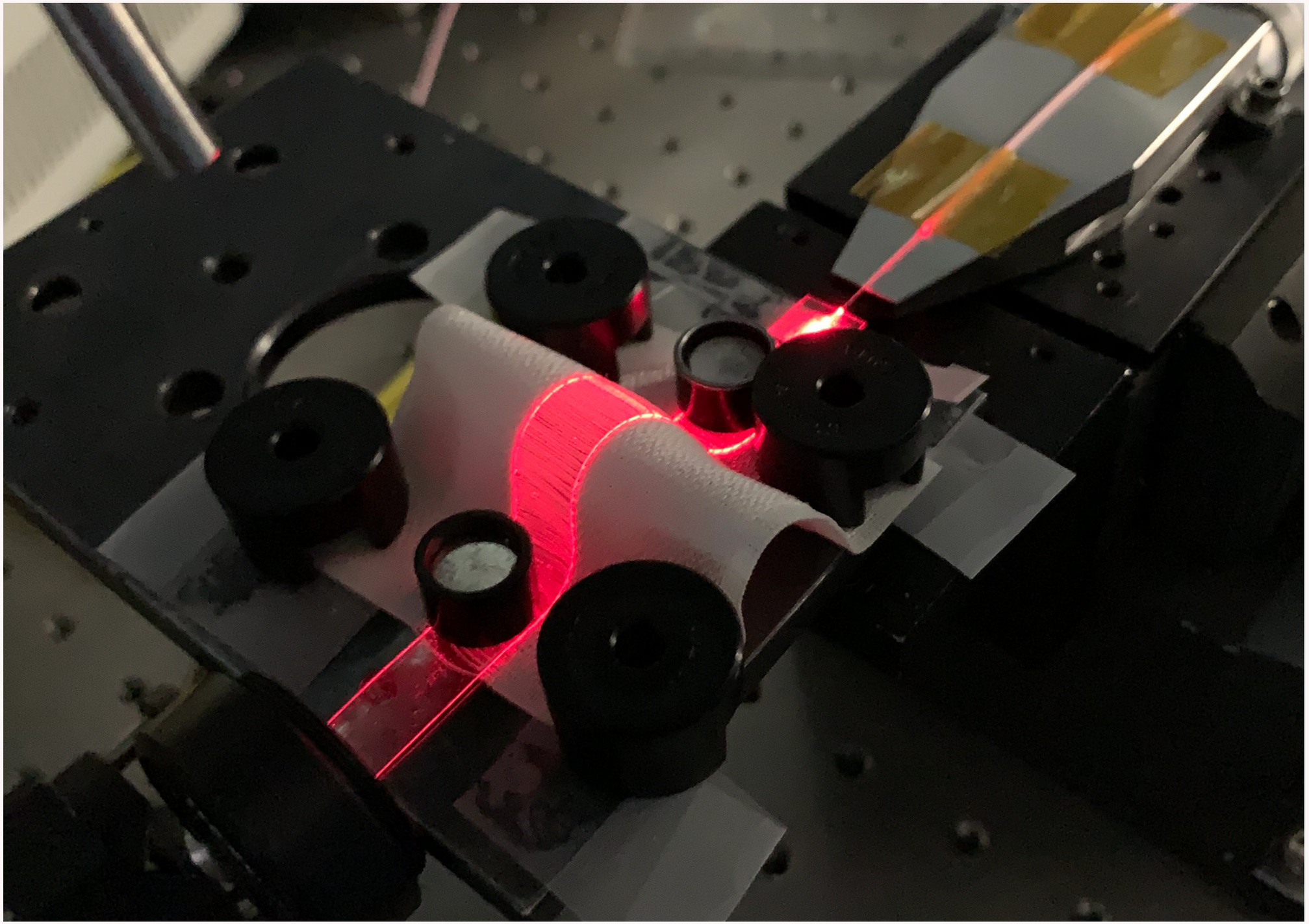
ENGINEERING

INTERACTION DESIGN

Cellulose

Hosokawa Micron Powder Systems

MAIN CHARACTERISTICS	FORMATS	COMBINATIONS with	*through*	PROCESSES
Most abundad organic polymer on earth Renewable source Biocompatible Biodegradable Reusable	Powder Gel Films Fibers	Glycerol Dyes		Coating Extrusion Wet spinning Casting 3D printing



Sofia Guridi, Light Tissue, 2022

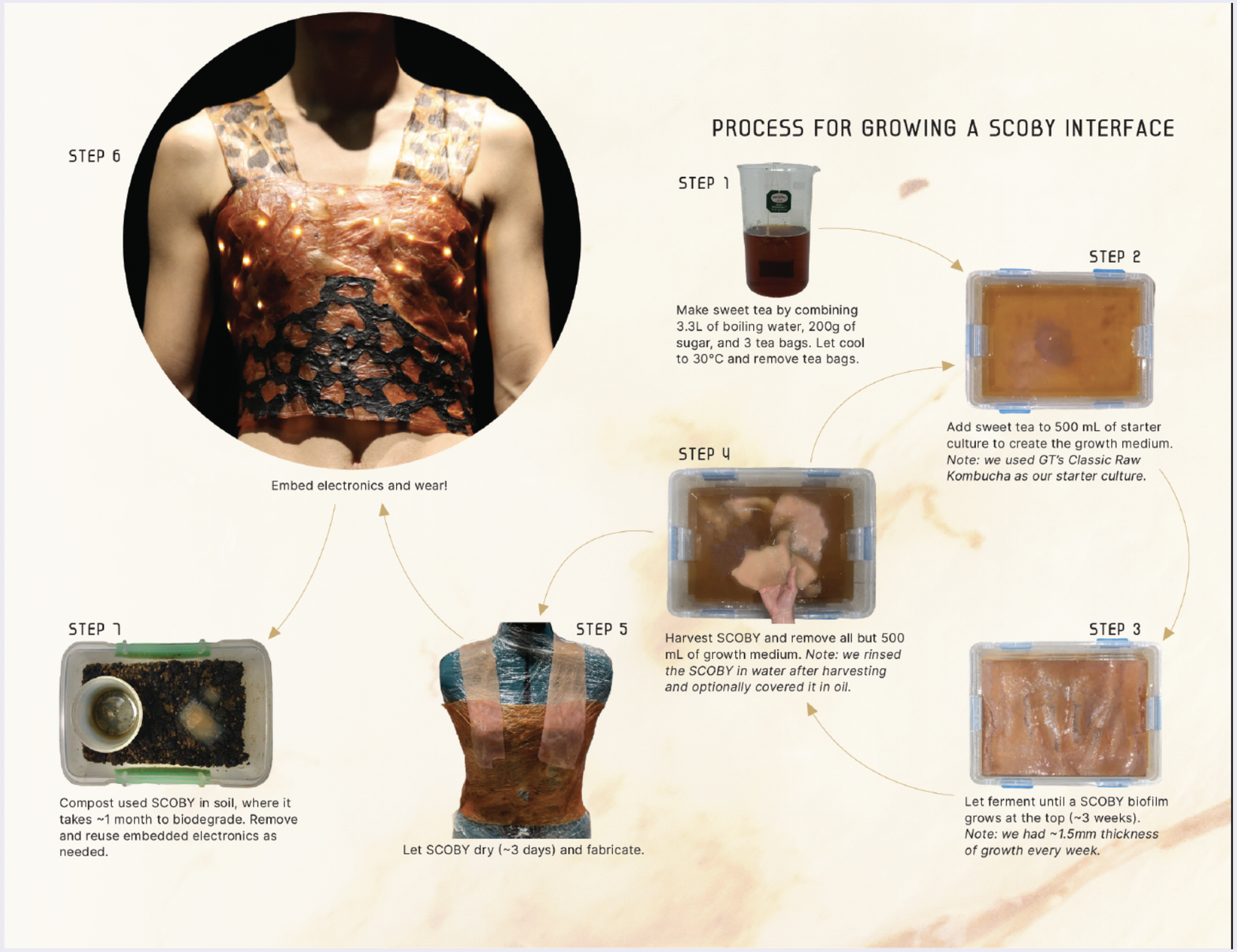
Sofia Guridi, London Design Biennale, 2023

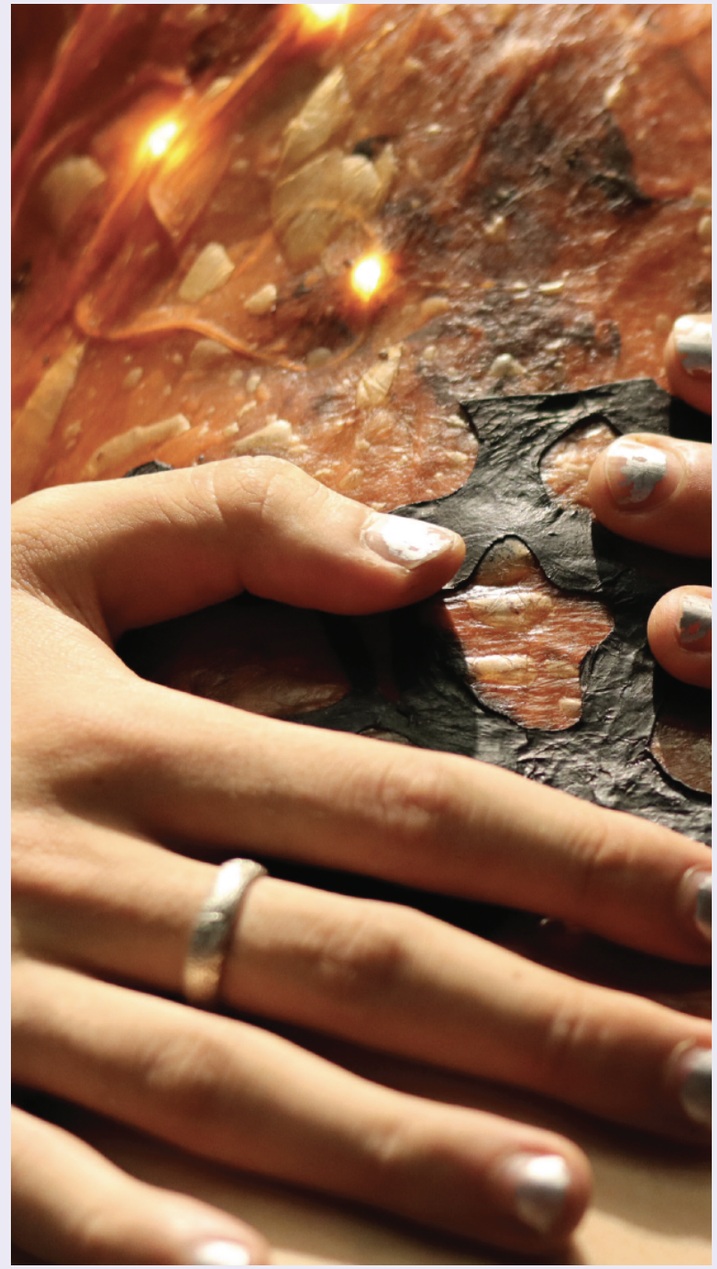
Bacterial cellulose

TCC Materials Circularity (MC), 2022

MAIN CHARACTERISTICS	FORMATS	COMBINATIONS with	*through* → PROCESSES
Flexible	Films	LEDs	Mold growth
Binder	Sheets	Yarns	Drying
Renewable source		Activated Carbon	Pleating
Biodegradable			Dyeing
Biocompatible			

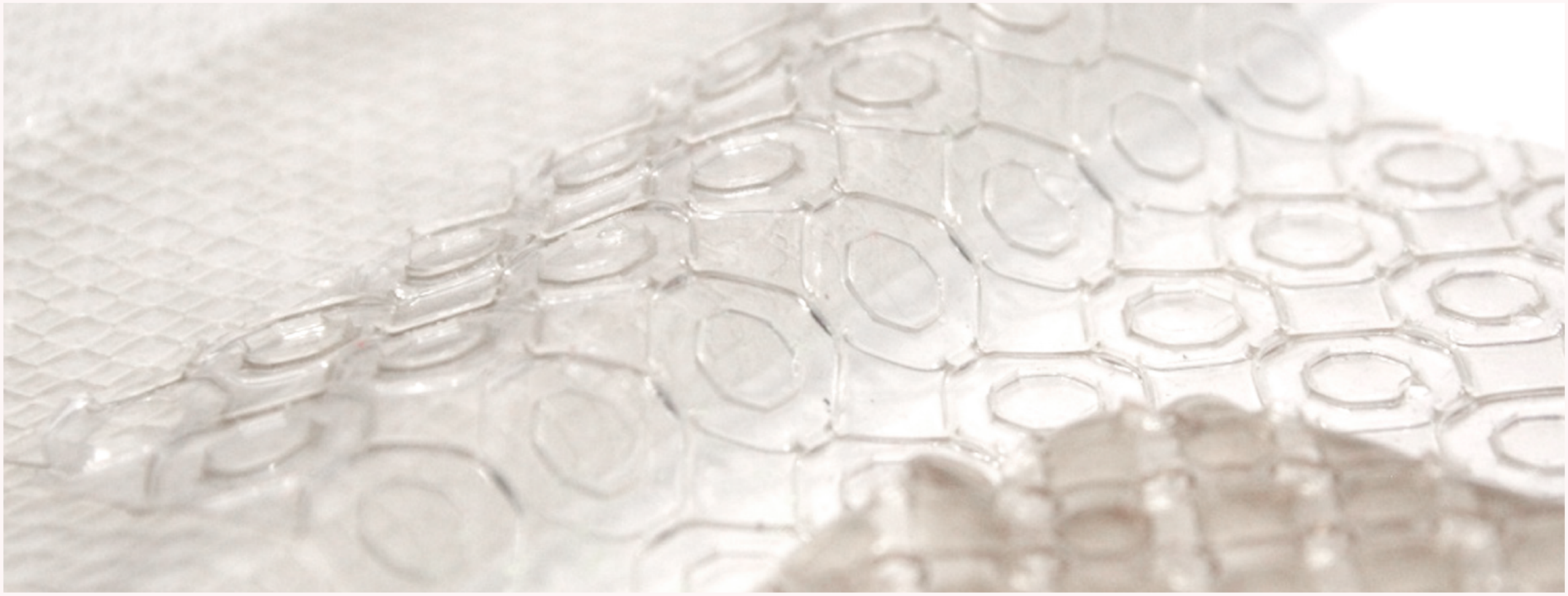
Bacterial cellulose





Scoby Breastplats: Slowly growing a microbial interface
Bell, Chow, Choi and Alistar. 2023

Gelatin



Clara Davis, 2017

MAIN CHARACTERISTICS

Transparent
Hydrophilic
Renewable source
Biocompatible
Biodegradable
Reusable

FORMATS

Foam
Sheets

COMBINATIONS with

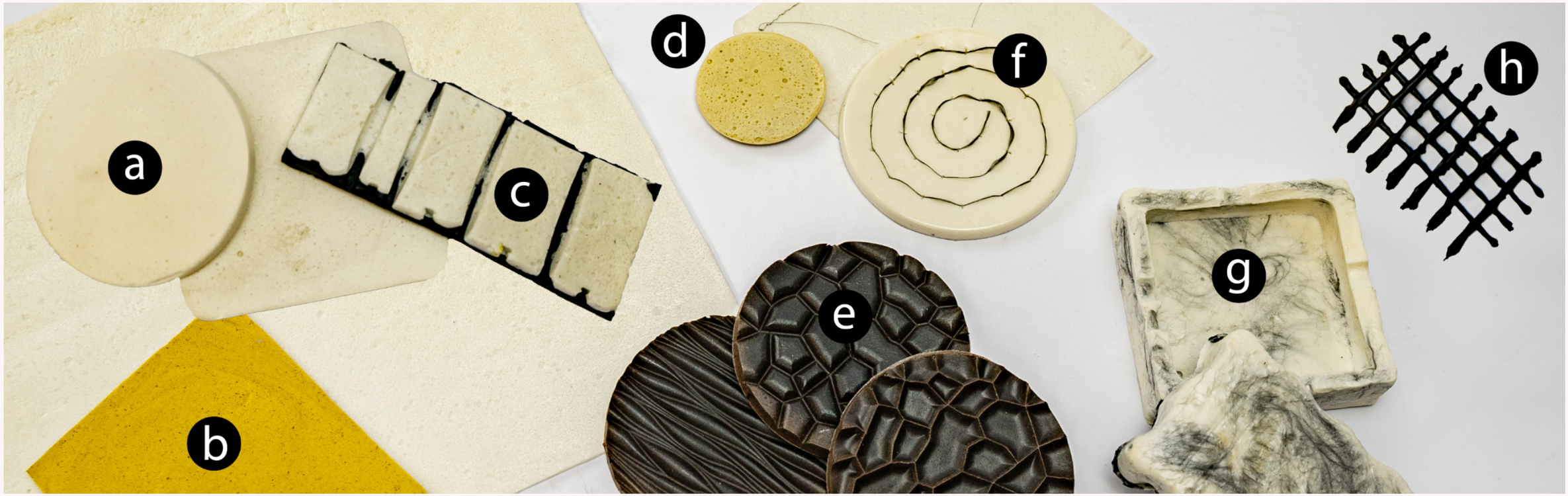
Turmeric powder
Walnut hull powder
Pine tree sap
Stainless steel fibers
Activated charcoal
Flaxseed

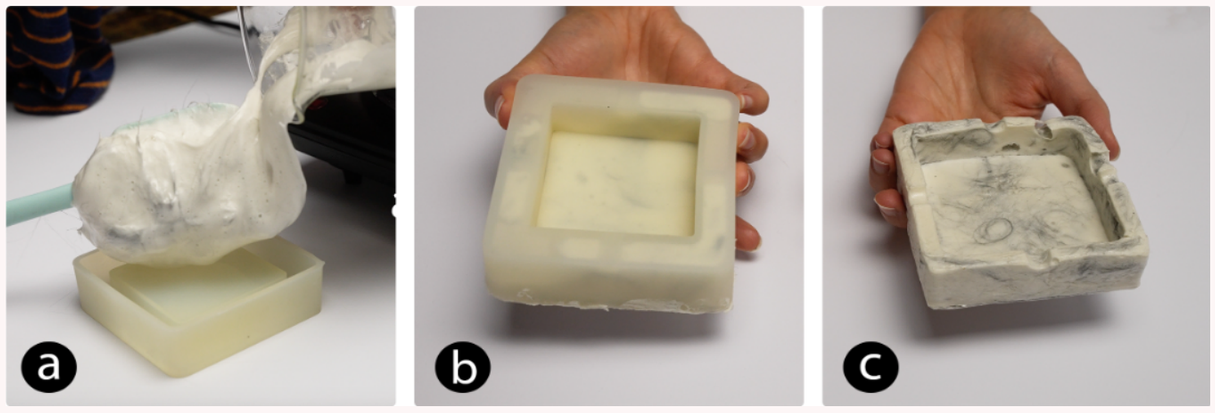
through

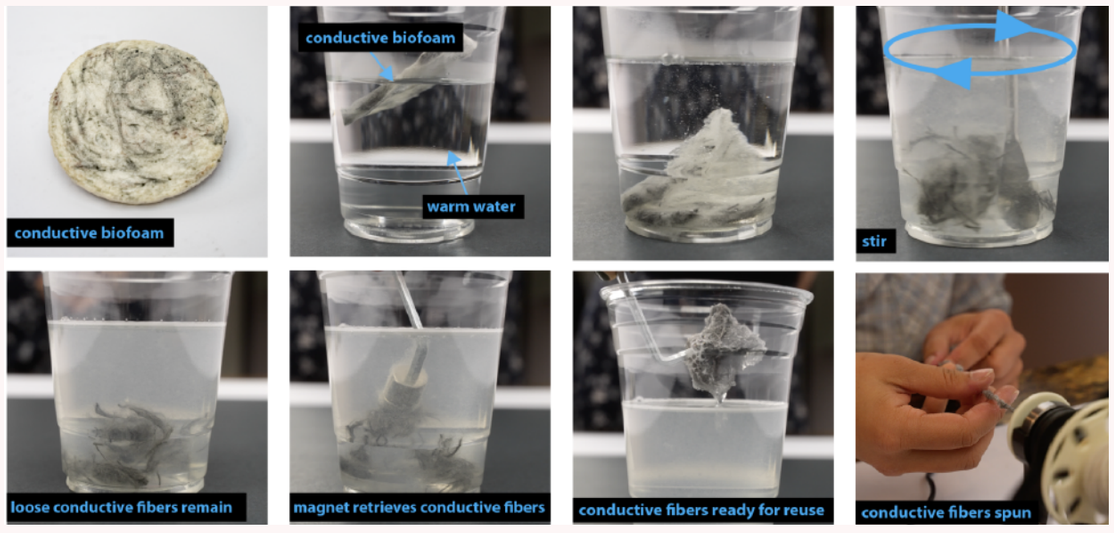
PROCESSES

Mold casting
Felting
Folding

Gelatin

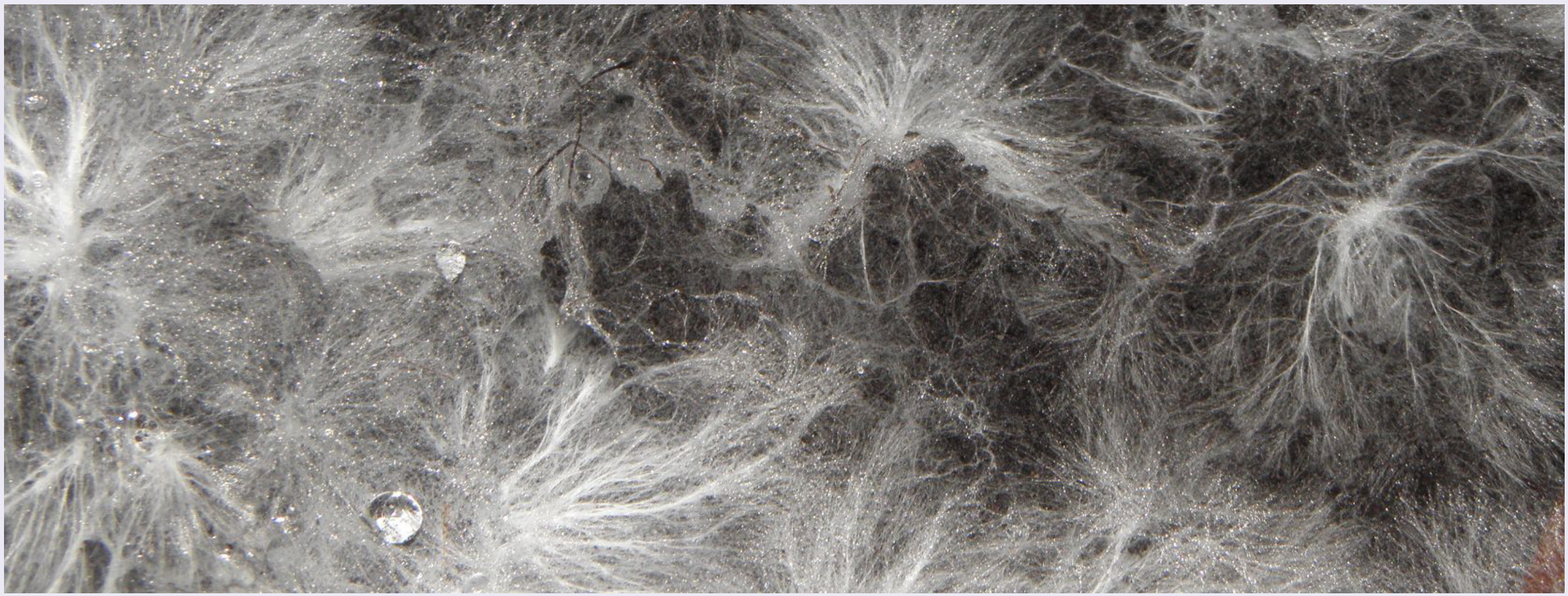






Exploring Biofoam as a Material for Tangible Interaction
Lazaro Vasquez, Ofer, Wu, West, Alistar, and Devendorf. 2022

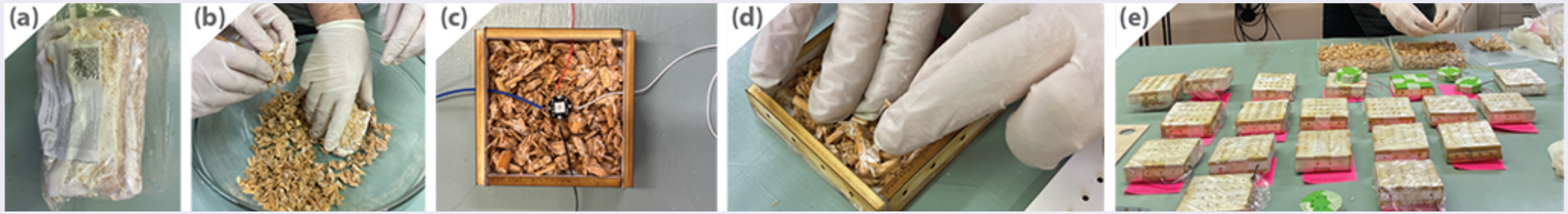
Mycelium

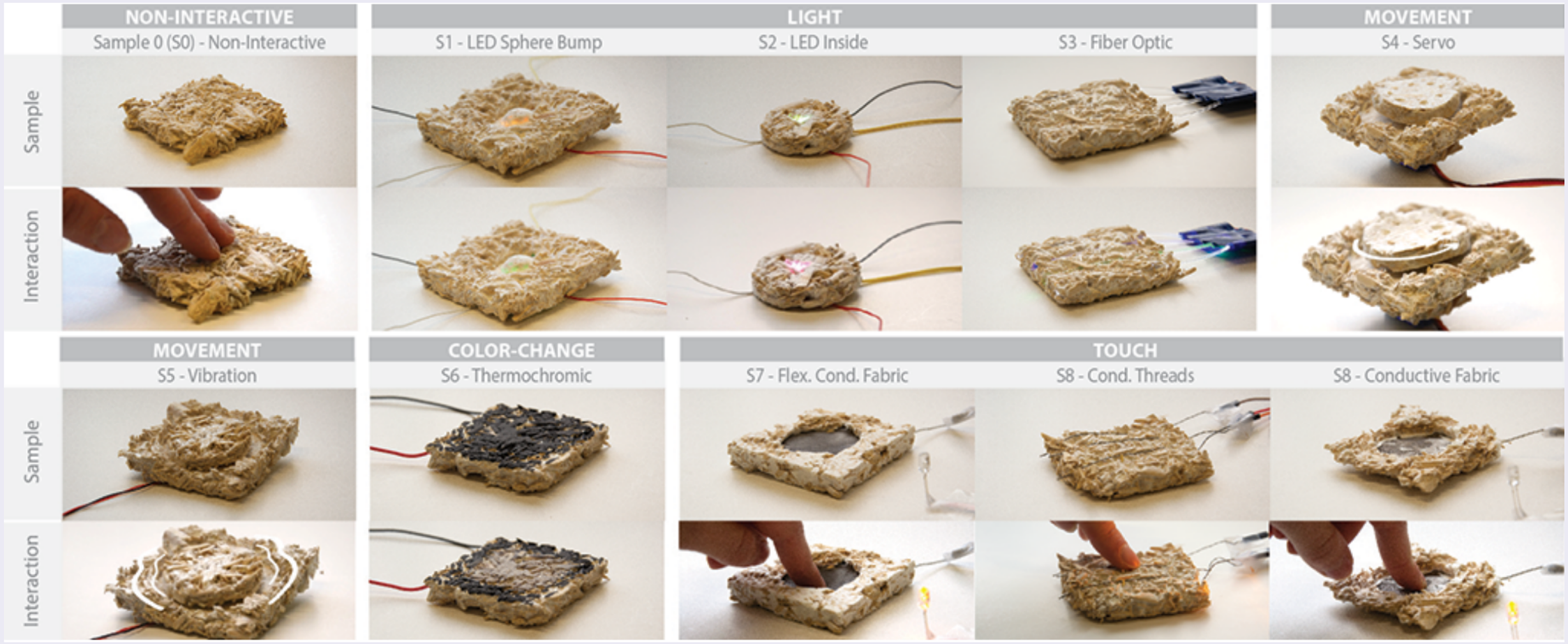


Rob Hille

MAIN CHARACTERISTICS	FORMATS	COMBINATIONS with	*through*	PROCESSES
3D shapes	Cases	LEDs		Mold growth
Binder	Thick sheet	Optical fibers		
Renewable source		Servo motors		
Biodegradable		Micro-vibration		
Biocompatible		Motors		
		Thermochromic inks		
		Conductive thread		
		Fabrics		

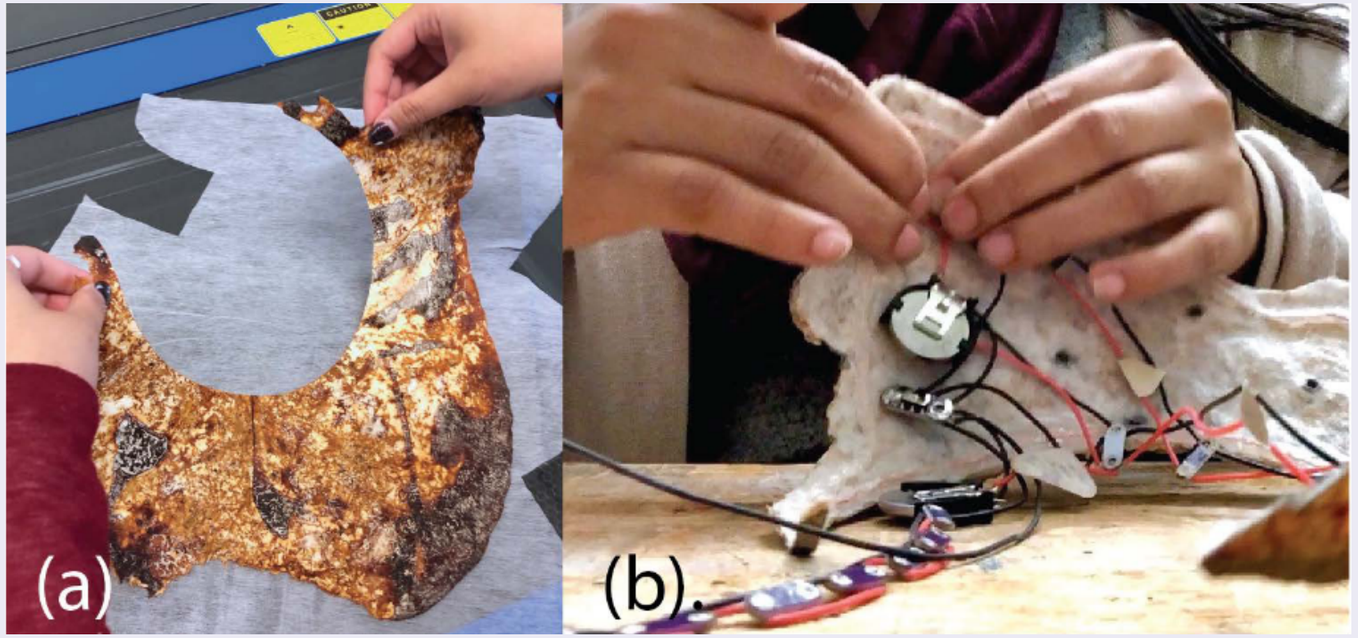
Mycelium





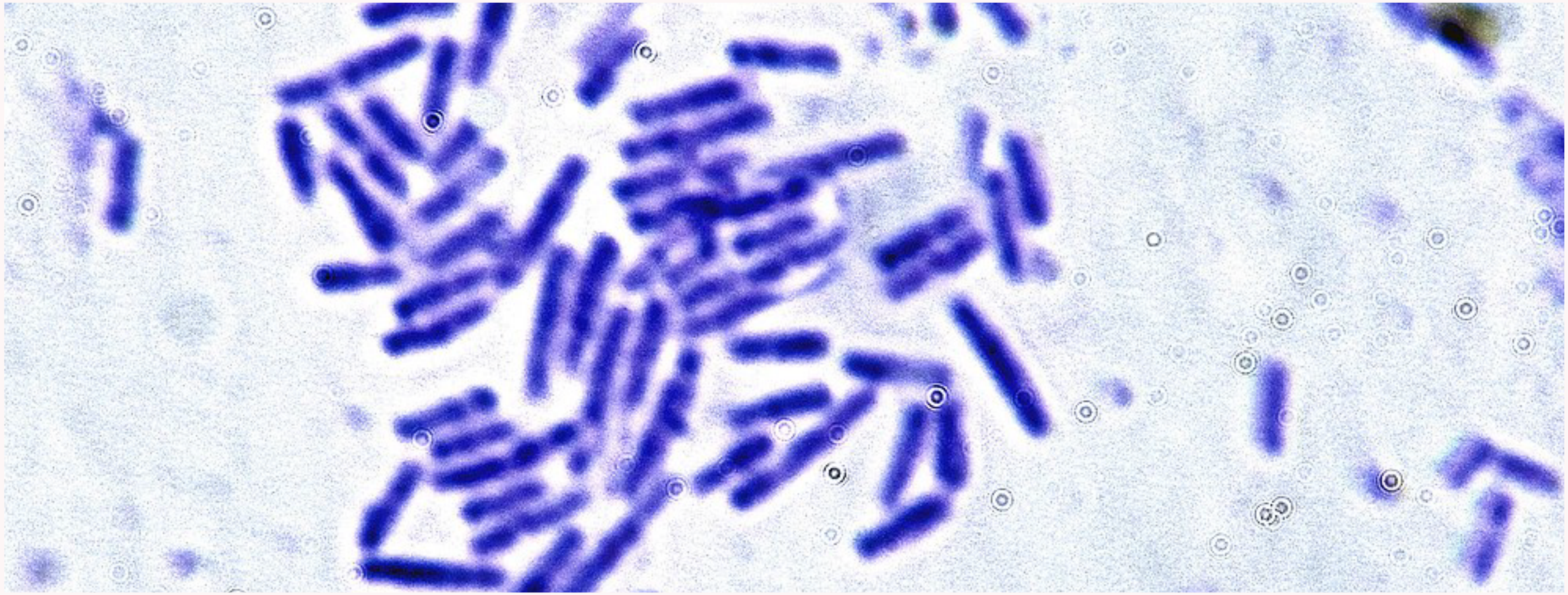
Interactive Mycelium Composites: Material Exploration on Combining Mushroom with Off-the-shelf Electronic Components
Genç, Launne, and Häkkilä. 2022

Mycelium



Myco-accessories: Sustainable Wearables with Biodegradable Materials
Lazaro Vasquez, Vega, 2019

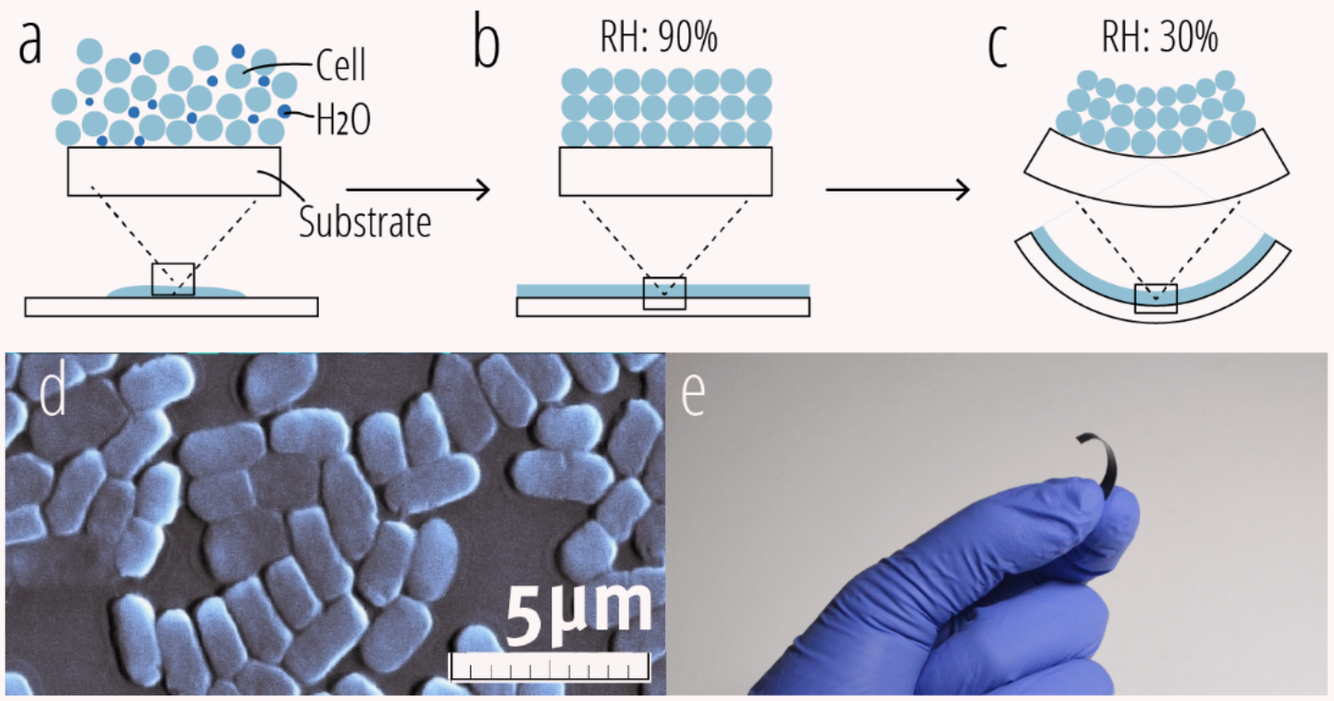
Bacillus Subtilis



Graham Beards , 2021

MAIN CHARACTERISTICS	FORMATS	COMBINATIONS with	*through*	PROCESSES
Hygromorphic behavior	Film	Latex		Manual pipeting
Renewable source		Kapton		Inkjet printing
Biocompatible		PET		Atomizing
Biodegradable		Conductive ink		

Bacillus Subtilis



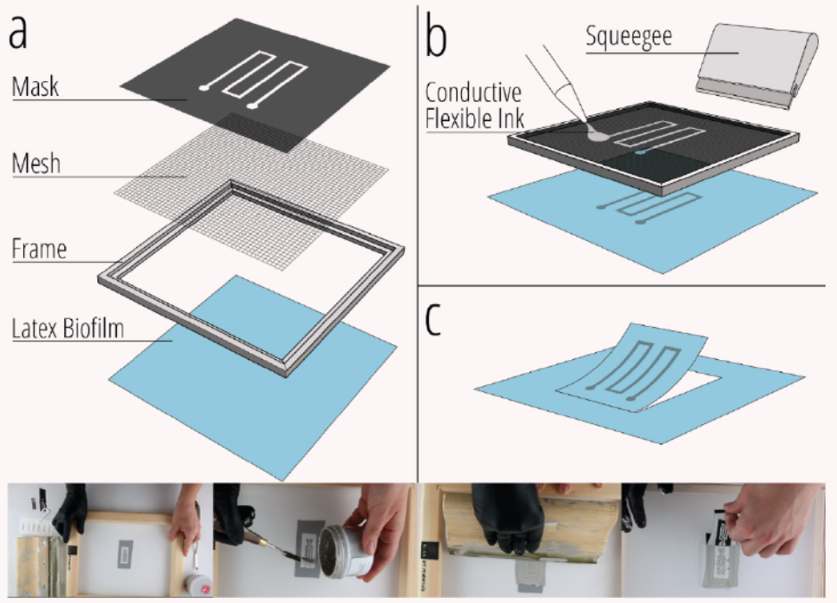
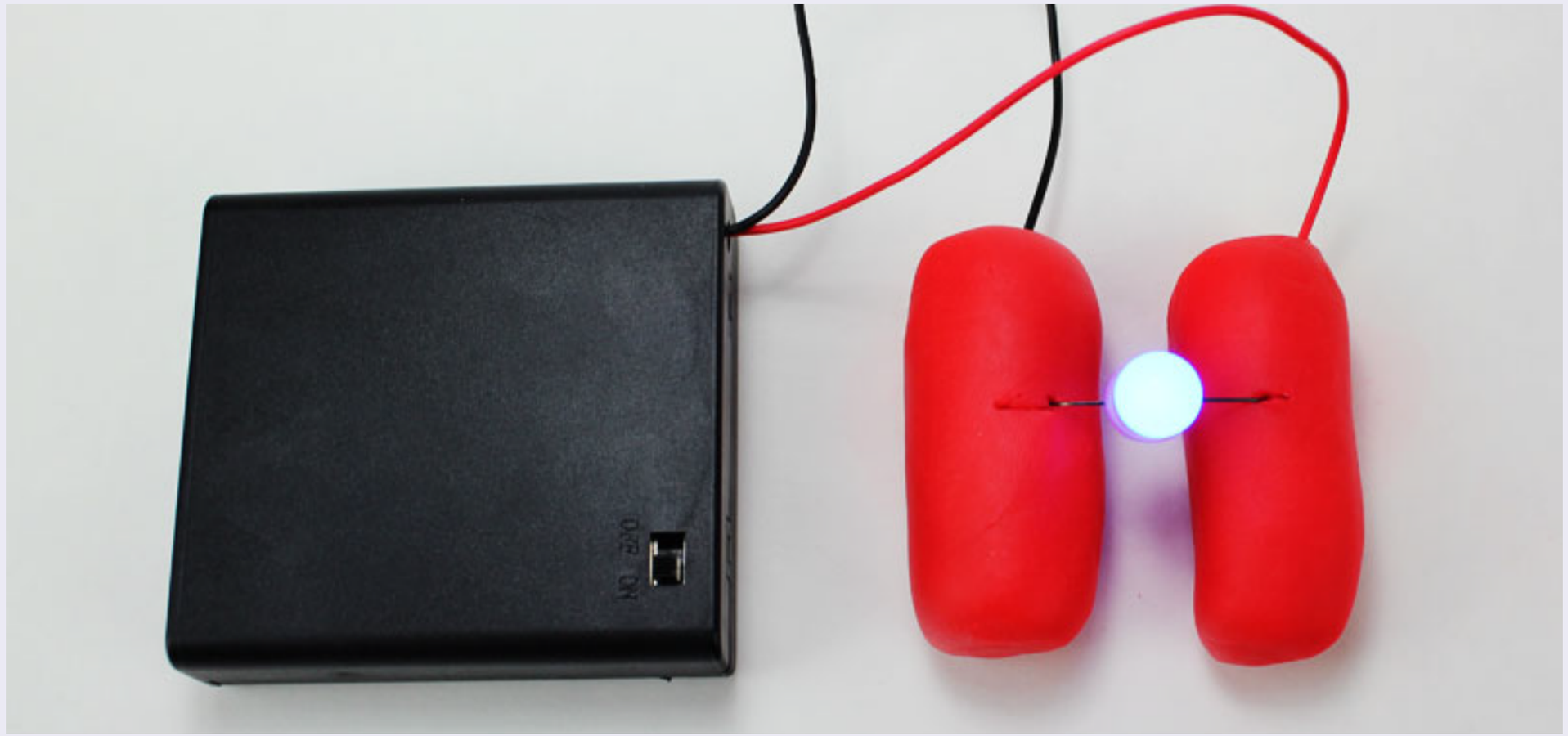


Figure 4: Process of screen printing flexible circuit onto the biofilm

bioLogic: Natto Cells as Nanoactuators for Shape Changing Interfaces
Yao, Ou, Cheng, Steiner, Wang, Wang, and Ishii. 2015

Iontronic flour



Makerspaces.com, 2017

MAIN CHARACTERISTICS

Conductive
3D shapes
Stretchable
Renewable source
Biocompatible
Biodegradable
Reusable

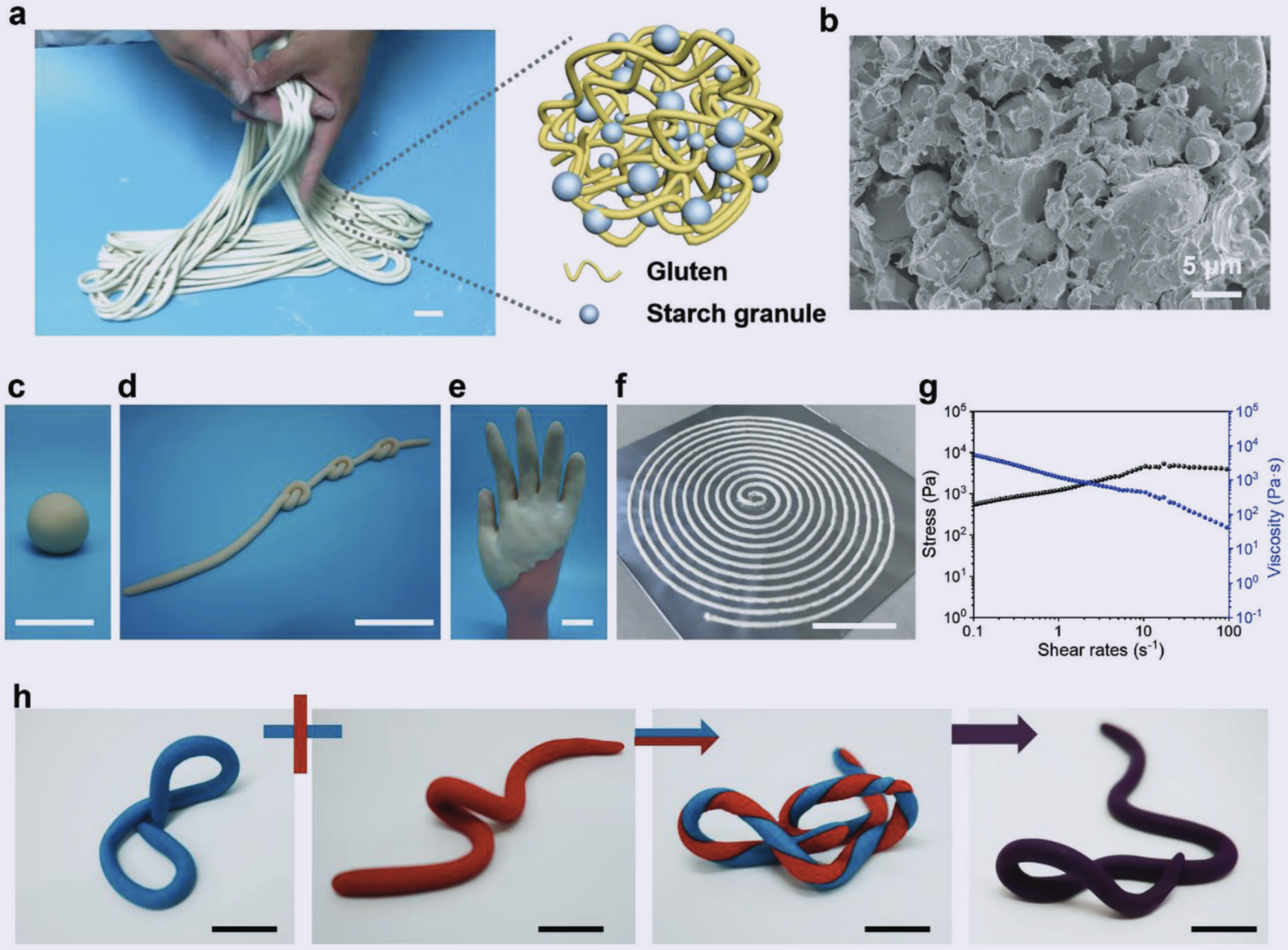
FORMATS

Dought

PROCESSES

Kneading

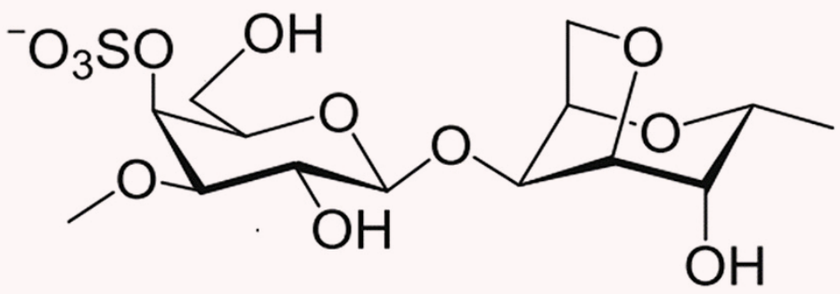
Iontronic flour



Traditional Dough in the Era of Internet of Things: Edible, Renewable, and Reconfigurable Skin-Like Iontronics
Lei, Huang, and Peiyi Wu. 2020

κ-Carrageenan

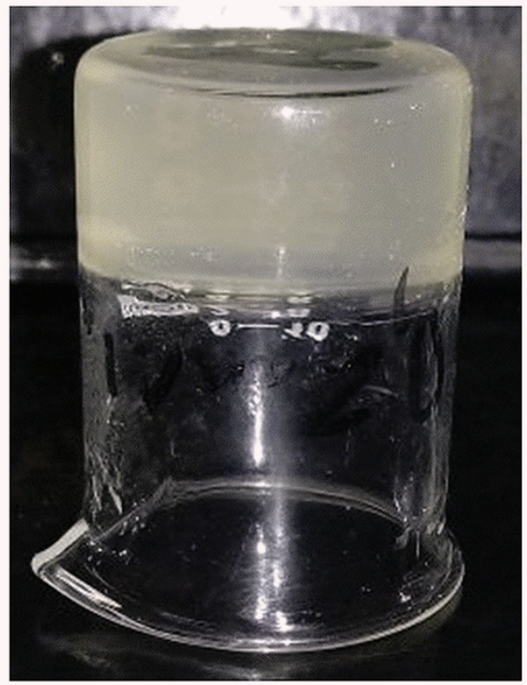
Commercial κ-carrageenan



4.0 wt% or 5.0 wt%

i) Aqueous solution (65 °C)

ii) Cooling (25 °C)



A durable superabsorbent hydrogel

Berton et al., 2020

MAIN CHARACTERISTICS	FORMATS	COMBINATIONS with	*through* → PROCESSES
Hydrophilic polymer Renewable source (seaweed) Biocompatible Biodegradable Reusable	Hydrogel	Textile	3D printing

κ-Carrageenan

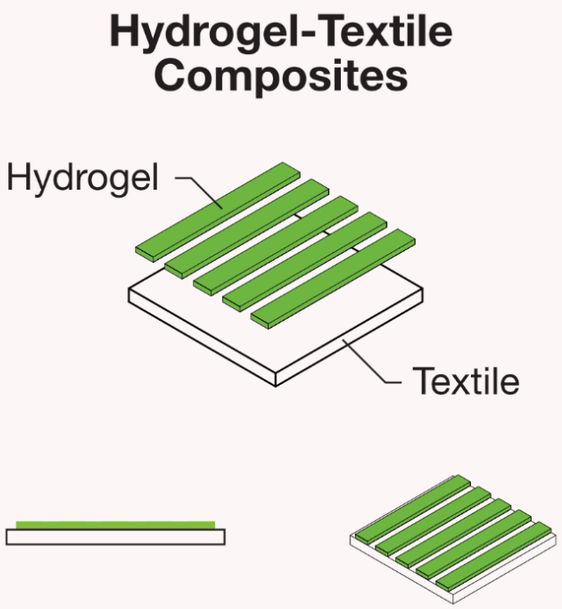


Figure 1: Hydrogel-textile composites are fabricated by 3D printing hydrogel patterns onto textile substrates.

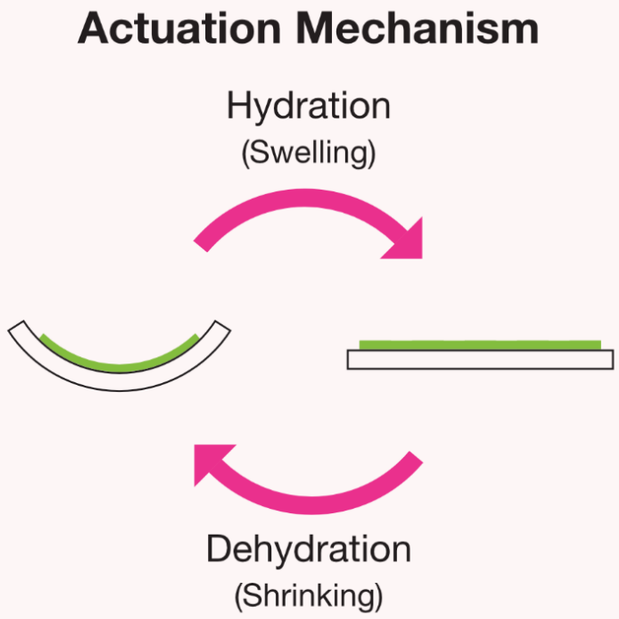
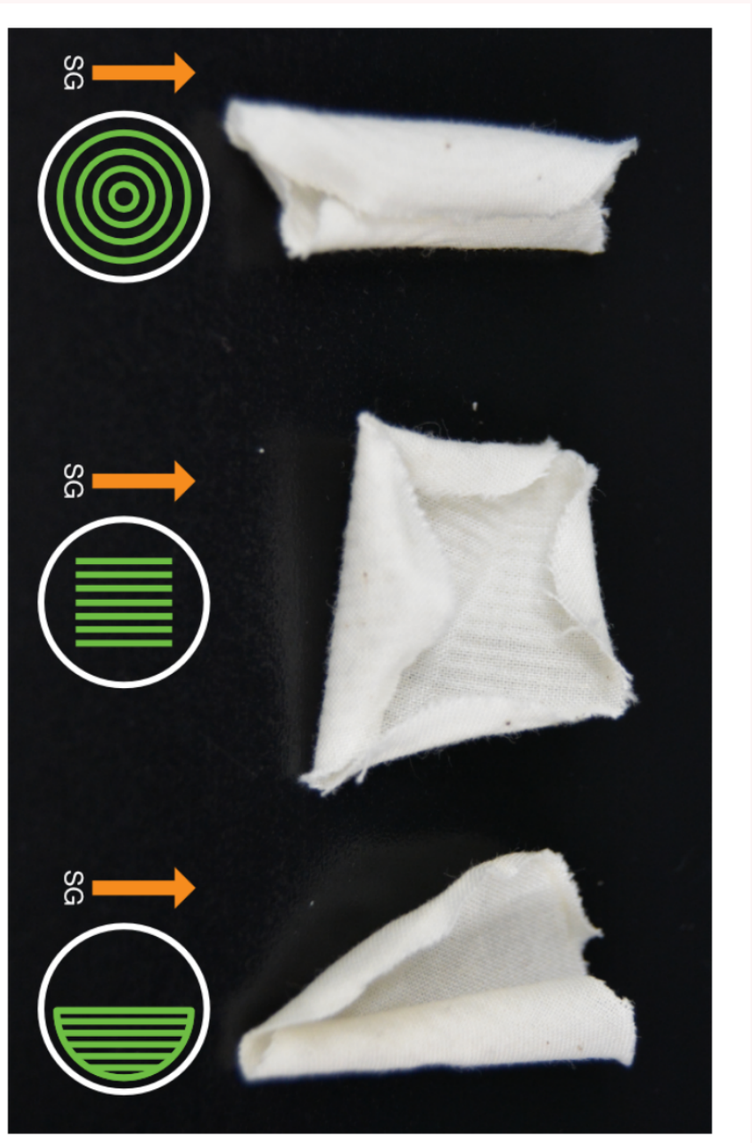
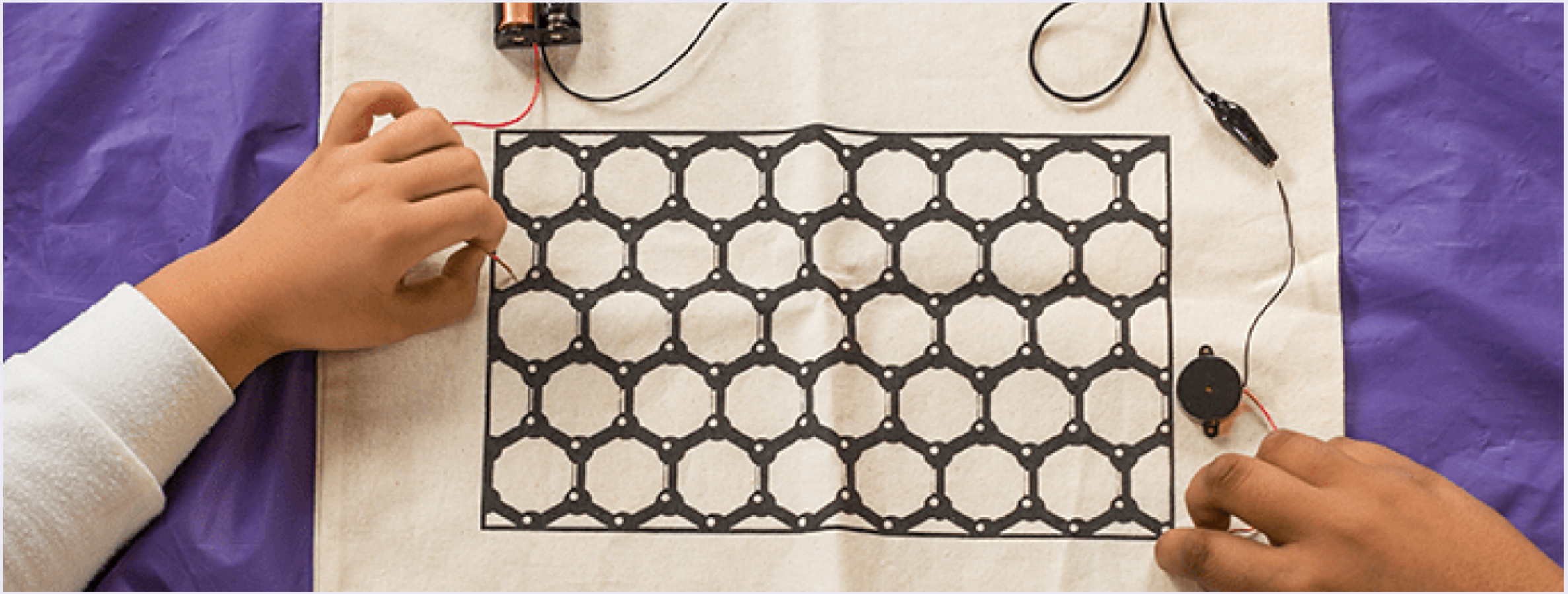


Figure 2: Hydrogel-textile composites actuate in response to water. As they dehydrate, or dry, they reverse their actuation.



Hydrogel-Textile Composites: Actuators for Shape-Changing Interfaces
Rivera, Forman, Hudson and Yao. 2020

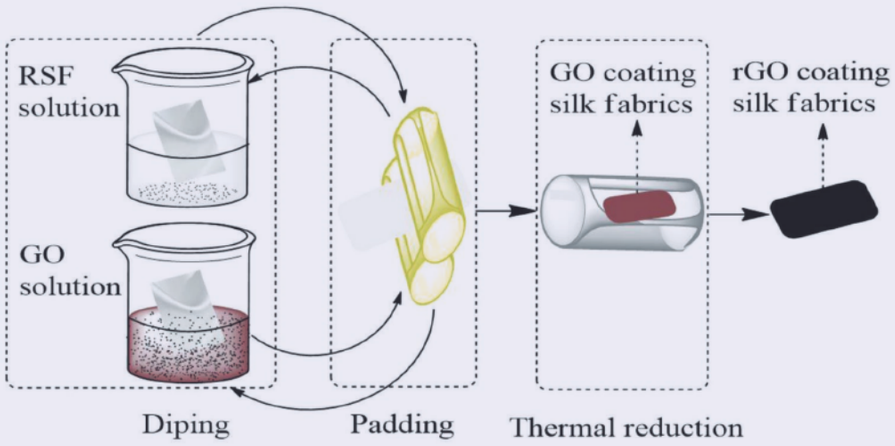
CARBON-based: Graphene, Carbon nanotubes, Carbon Black

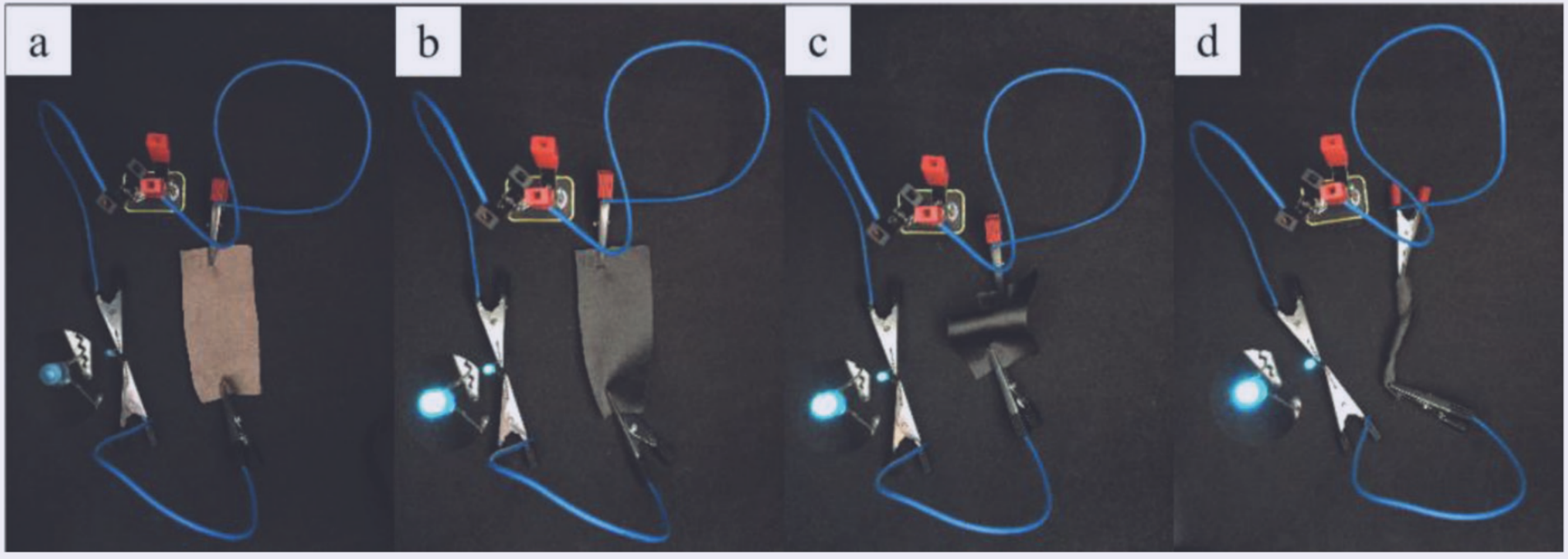


NISE Network, 2016

MAIN CHARACTERISTICS	FORMATS	COMBINATIONS with	*through* → PROCESSES
Biomass	Inks	Cotton	Coating
Conductive	Yarns	Bamboo	Spraying
Lightweight	Textiles	Silk	Inkjet printing
High tensile strenght	Foams	Polyester	Screen printing
Degradable		Nylon	
		PEDOT:PSS	
		PET/PTT	

CARBON-based





Reduced Graphene Oxide Coated Silk Fabrics with Conductive Property for Wearable Electronic Textiles Application
Zulan, Zhi, Lan, Sihao, Dayang, and Fangyin. 2019

!

Biomaterials based on the Territory

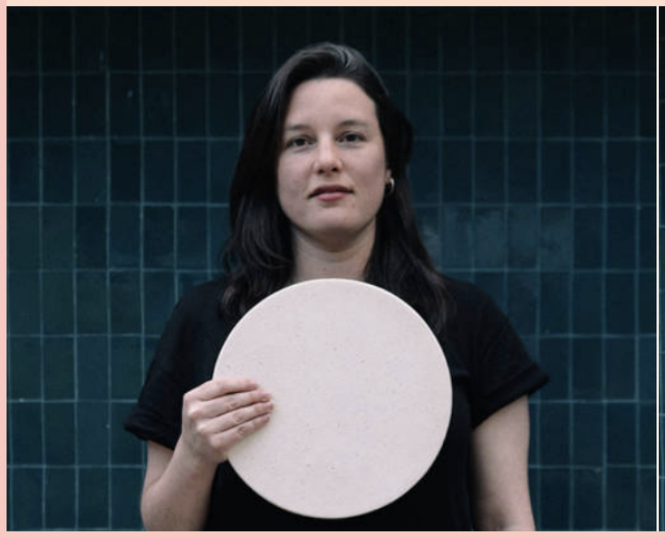
VALDIVIA · CHILE

www.labva.org

INICIO SOMOS RESIDENCIA MEDIA

Desde el sur de Chile promoviendo nuevas materialidades

Situado en la ciudad de Valdivia al sur de Chile, trabajamos desde un foco territorial y transdisciplinar, cuestionando las materialidadesque nos rodean y la cultura asociada a éstas para promover la investigación, experimentación y prototipado de nuevas materialidades como herramienta de divulgación medioambiental y empoderamiento ciudadano.



Resources

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Biobased materials are on the rise: Watch these spaces

7th September 2023

What do we mean by "regenerative" materials?

5th September 2023

Materiom's vision for a materials revolution

22nd May 2023

Gracias!