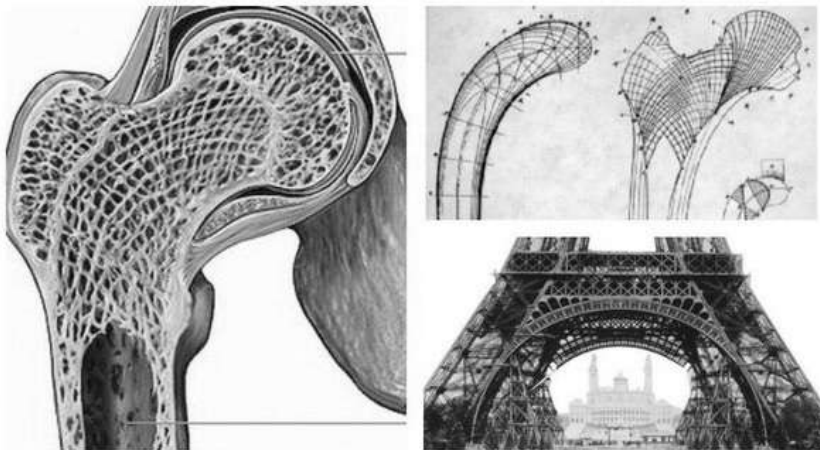


Smart Textiles and Biomimicry

While researching on biomimicry and smart textiles I came across designer **Manel Torres** who invented Fabrican which is an instant spray-on fabric technology that creates a non-woven fabric when applied to any material. This spray on fabric is sterile as well and after being further developed, has many medical uses such as waterproofing, bandages, casts, wound healing products, patches and many other innovative uses.



A really interesting fact I learnt through research as well is that the Eiffel tower was the product of biomimicry. In 1866, a swiss engineer, Karl Cullman discovered that the structural make up of the human femur makes the bone very strong and replicated its fibre structure in his design to invent a crane. This design later inspired the strong, crisscross metal structure of the Eifel tower while its wide base resembles the top of the femur, giving it a strong footing.



Smith and Nephew

Smith and Nephew are a leading portfolio medical company that exists to restore people's bodies and their self-belief. Their advanced wound management portfolio provides products that meet broad and complex clinical needs which include plasters, ointments, wound dressings and more.

While studying some of their products, I came across Zinc oxide paste bandages.

Paste bandages for eczema are impregnated with a paste containing zinc oxide and can contain ichthammol as well. These are soothing and cooling ingredients that help to relieve irritation. There are several types available such as Viscopaste and Ichthopaste, including Zipzoc, which is more like a stocking than a bandage.

These bandages can be worn around the legs, feet, hands and as sleeves for the arms.

What is eczema?

eczema is a skin condition that causes the skin to become itchy, dry and cracked. It is linked to a gene variation which affects the skin's ability to provide protection. This allows the skin to be affected by environmental factors, irritants and allergens. The most common affected areas in Atopic eczema include the hands, insides of the elbows, back of the knees and in children, the face and scalp as well. In some children, food allergies may play a role in causing eczema. Air born allergens include dust mites and pollen. Other triggers include exposure to water, cold air, hot weather, detergents, scented products, sweat, stress and anxiety and fabrics such as wool and polyester agitate the skin as well. Atopic eczema is the most common form of eczema and is most common in children up to the age of 6. Atopic eczema does improve with age; however it can reoccur, flare up or develop in adulthood as well.

My product and client for this project.

For this project, I want to focus on designing a cover for paste bandages and wet wraps used to sooth eczema. My main target age group for this new product is young children. Children part take in various school activities that may aggravate their eczema. Sports that may cause sweating, friction, and the spread of dirt or mud, dust mites and fibres from carpets and other surfaces in the classroom, hand soaps in school bathrooms and added school stress.

Studies have shown that 1 in 5 children experience bullying in school in relation to eczema and more than 75% of parents have reported that their children who have been bullied due to their eczema have experienced lower self esteem as a result. While schools must adapt more strategies to raise awareness on diseases to educate the young, I want to create a playful, child-friendly covering that will boost the users' confidence and be practical for school related activates.



Textiles and Eczema

Human skin is in close contact with textiles most of the time. What is the best fabric for soothing eczema?

synthetics such as polyester, rayon, nylon, spandex, or rubber can agitate the skin. they do not breathe as well as natural fibers, and cause you to sweat more. Dyes and chemicals used in clothes can aggravate eczema as well. Resins used to make garments wrinkle-free or dirt-repellent can also cause problems.

Experts generally recommend looking for clothing made from natural fibres such as cotton or silk however, this may not work in every case. Along side cotton and silk, bamboo and lyocell have also proven to be affective in soothing eczema.

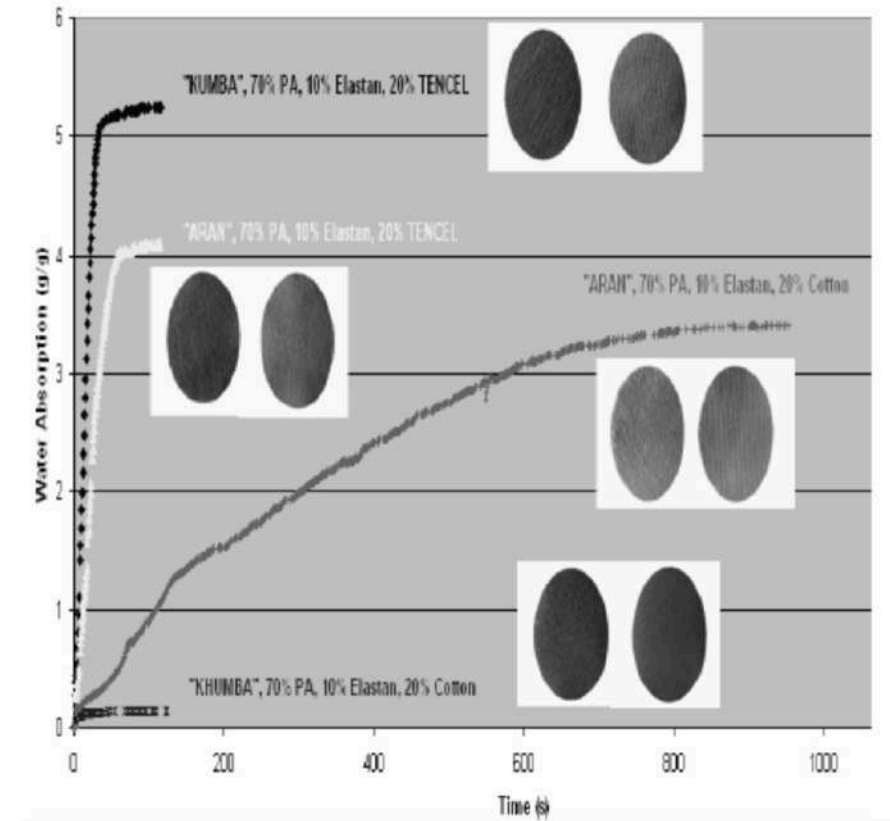
While doing thorough research on the comparisons of different recommended fabrics such as cotton, silk and lyocell (regenerated cellulose), I decided that lyocell is the best material to use for customers with eczema.

While all cellulosic fibres have the 8 properties listed below:

- High absorbency
- Warm and dry (as an insulation layer)
- High heat capacity
- Cool and dry to the touch
- Can actively reduce temperature
- Neutral electric properties
- Strongly retards bacterial growth
- Gentle to the skin

Lyocell has a very high absorption capability, a unique nano-fibril structure and a very smooth surface.

Fibres with poor water absorption capacity result in textiles which cling to the skin. Wet skin is much more sensitive to irritation than dry skin. The coarseness and stiffness also have an impact on the skin's sensory perception. Both cotton and wool have rather good water absorbency, however, they have a rather rough fibre surface. Lyocell offers good breathability and moisture absorption, dry and cool micro-climate on the skin, smooth fibre surface, low wet cling effect and no electrostatic charging – mean that textiles made from lyocell might offer relief to people who suffer from skin diseases.



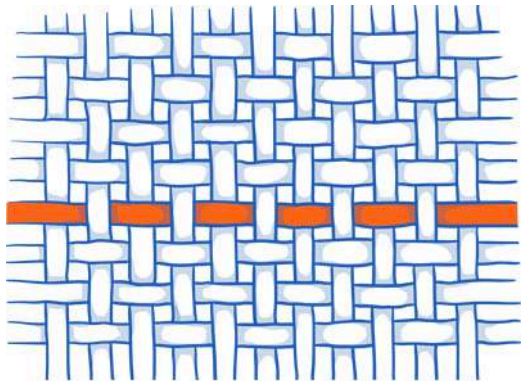
A graph showing the absorption capacity of Tencel (Lyocell) vs cotton

https://www.researchgate.net/publication/237548338_THE_FUNCTIONAL_PROPERTIES_OF_TENCELR_-_A_CURRENT_UPDATE

A clinical test was organized at the University Hospital in Heidelberg (Germany), led by dermatologist Professor Diepgen. 60 patients suffering from atopic dermatitis or psoriasis were asked to test commercially available TENCEL® (lyocell) products including bedding, T-shirts, polo-shirts and nightwear. People suffering from these conditions have had to refine their clothing to identify materials that will cause them the least discomfort.

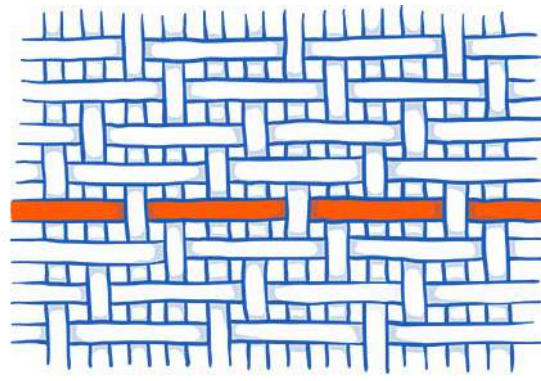
Approximately 80% of the patients suffering from atopic dermatitis or psoriasis preferred lyocell textile products over their normally used textiles.

While comparing cotton and lyocell I did more in-depth research on the surface character of the fibres and learned that there are different kinds of weaves such as percale, sateen, and twill, which add to the texture of fabrics. Cotton fabric is usually created using the percale weave, also known as plain weave, this is because this tight weave increases the durability of the fabric while usually, most lyocell fabrics have a sateen weave which is when one vertical thread is woven for every four horizontal threads. This type of weave produces a fabric with a soft, silk like feel.



percale weave

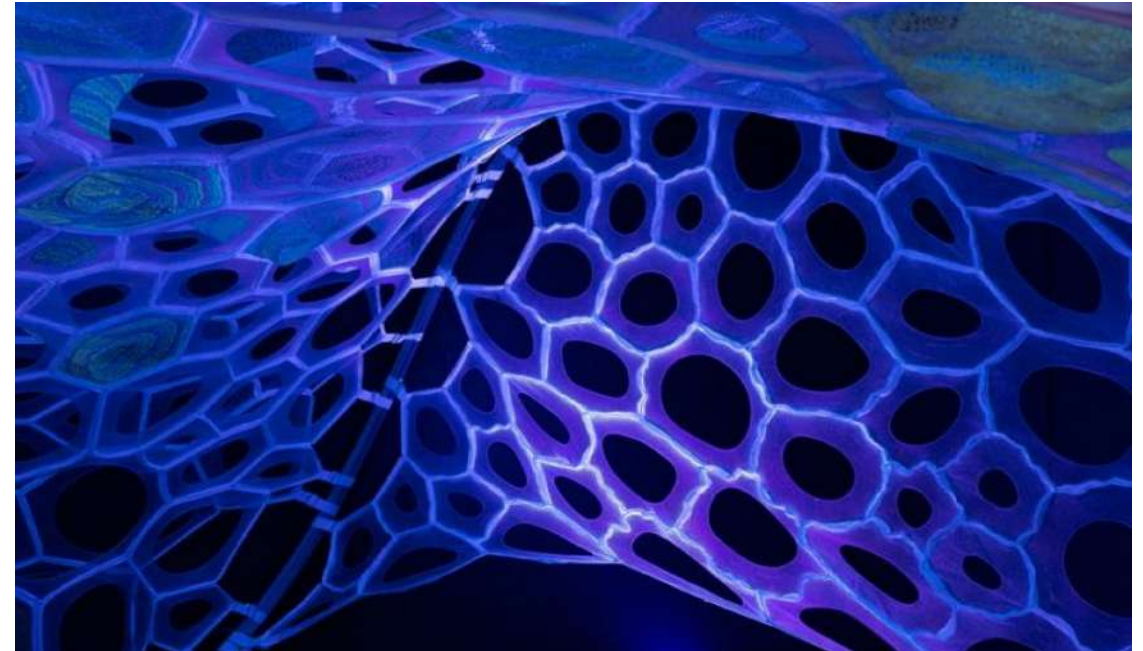
one thread over, one thread under



sateen weave

three threads over, one thread under

Structured pattern and Biomimicry in Design

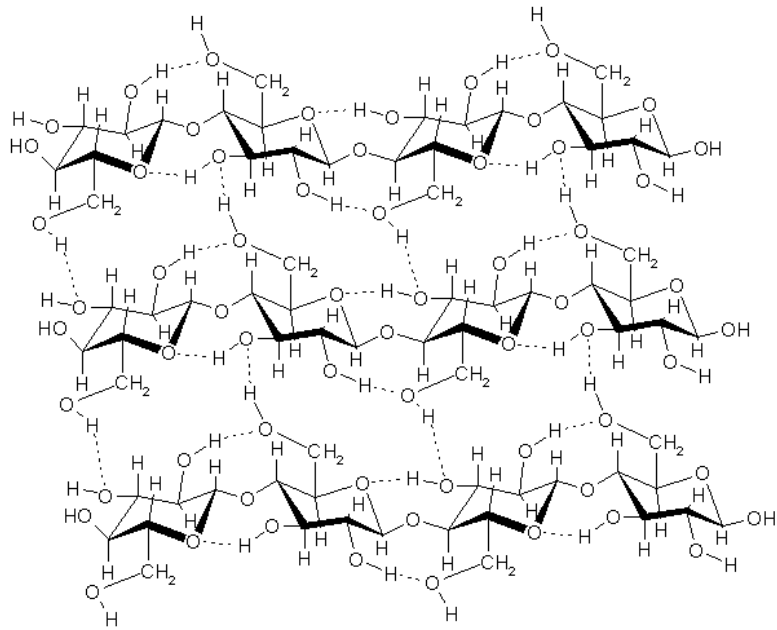


Jenny Sabin's textile pavilion is a multi-colored, temporary architecture made up of photo-luminescent and solar-active threads that absorb luminescence. Its architectural structure is inspired by nature.

Biomimicry is the imitation of models, systems, and elements of nature in design challenges while **structured pattern** defines how each component or entity in a formation should be structured in order to have flexible, interconnecting modules which function together in a larger system.

Cellulose as my structural pattern design

Through learning about which textile materials are best for people with eczema, which to avoid and why, I came across the word 'cellulose' on numerous occasions. I was really interested in discovering what cellulose is, how it is used in textiles, its structural make up and how it can be processed into different fabrics. In keeping with the project theme "structured patterns" I want to incorporate designs inspired by cellulose structures into my work as something that fascinates me and because of its relevance to my research so far.

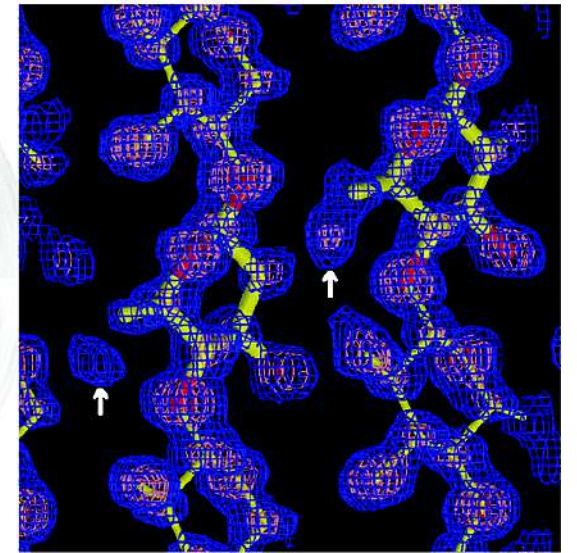
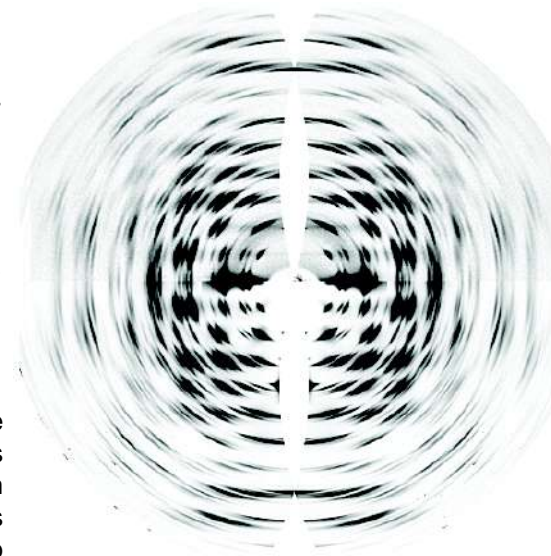


Looking at the chemical structure of cellulose.

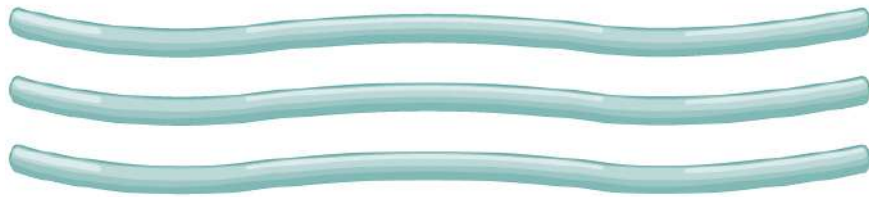
What is cellulose?

Cellulose is the main substance found in plant cell walls. It is a natural polymer which means it is a long, repeating chain of the same molecule bonded together. This molecule consists of hundreds and thousands of carbon, hydrogen and oxygen atoms. Cellulose provides extreme tensile strength while giving plants their shape and rigidity.

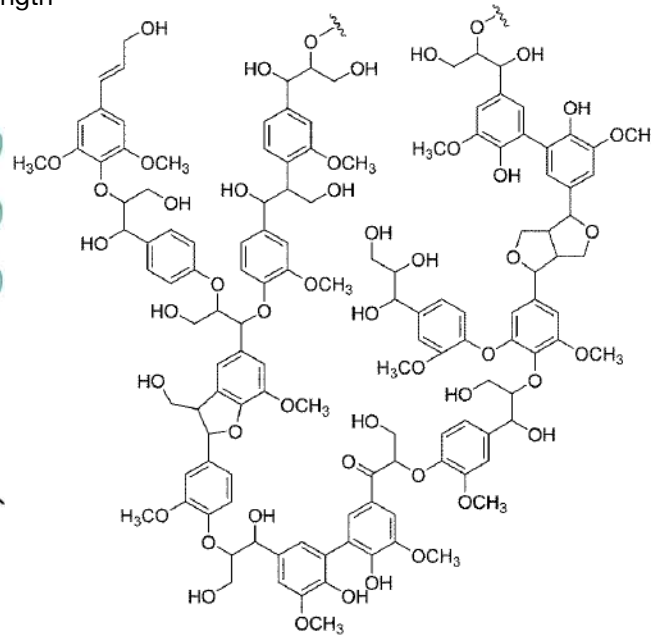
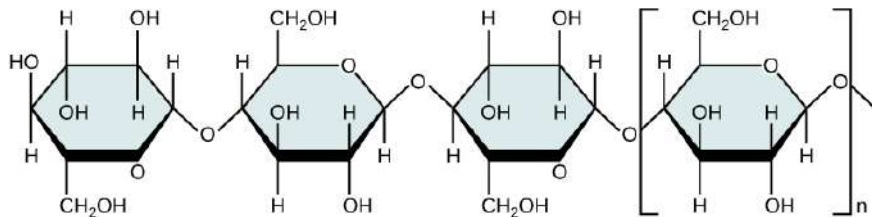
Wood and bamboo are natural fibre composites with high strength. Wood is composed of parallel tubular cells which are reinforced with cellulose fibrils winding round. This structural make up gives wood its properties of stiffness and strength



Cellulose fibers



Cellulose structure



Why is cellulose relevant to textiles?

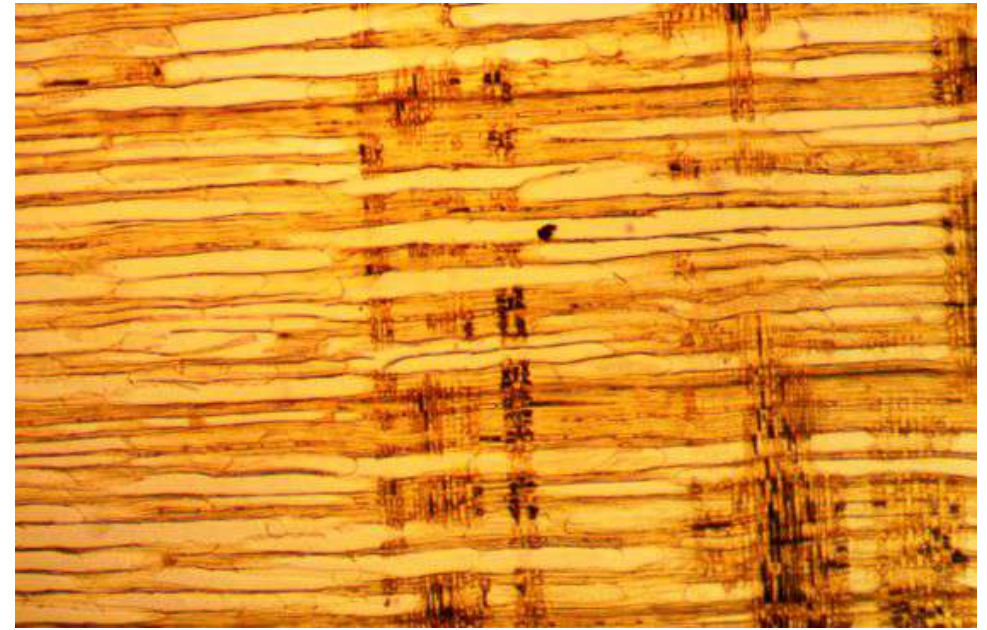
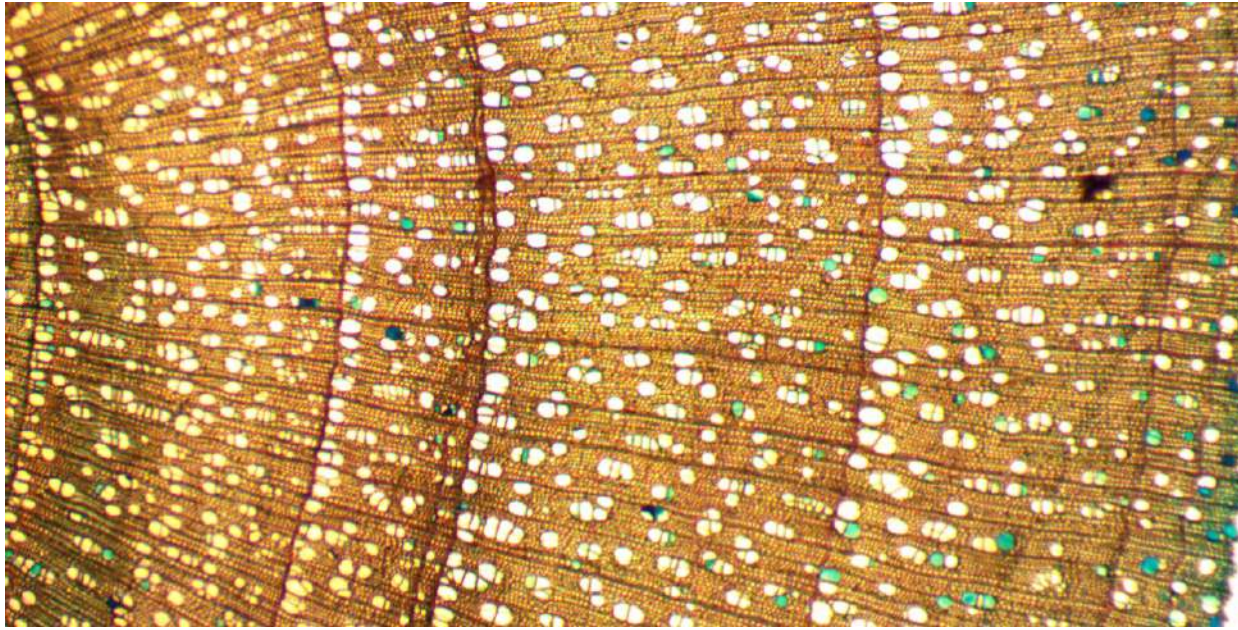
Cellulosic fibers are used for the production of fabrics such as cotton, flax, hemp, jute, linen, viscose, modal and lyocell.

Along side fabric production from natural cellulose such as cotton, fabrics are also produced from regenerated cellulose which is the process of dissolving natural cellulose derived from wood and converting the solution back into insoluble fibrous cellulose.

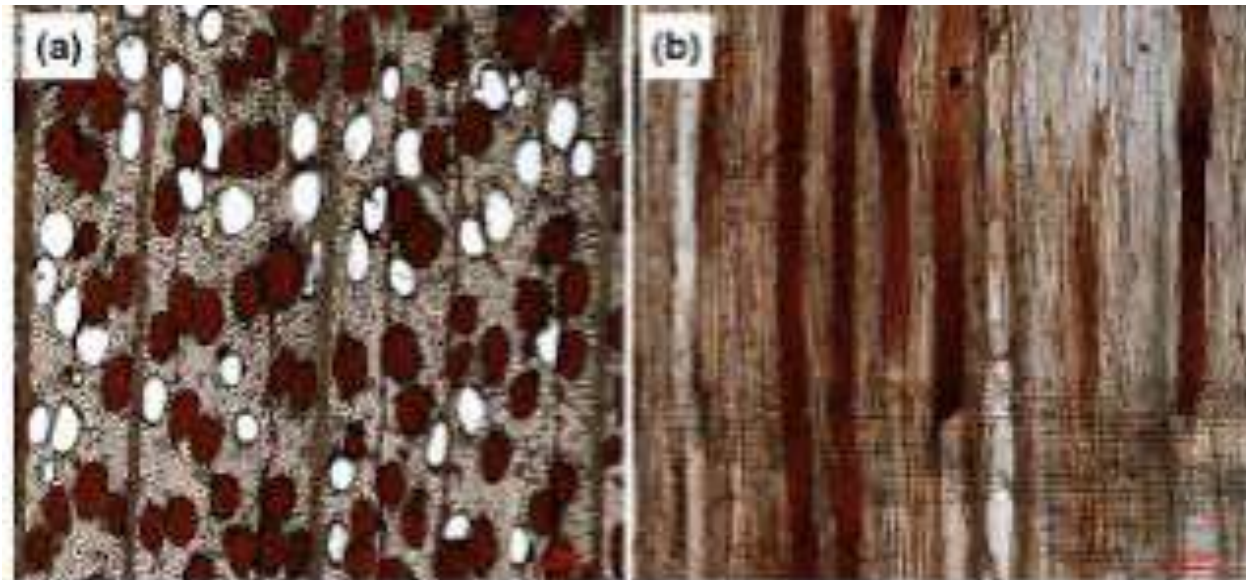
Cellulose fibres and medical uses

Cellulosic fibres such as cotton and rayon can be used for medical purposes. When treated with chloroacetic acid, the cellulose fibres become highly absorbent. Large amount of water can be absorbed into the fibre structure. The treated fibres are capable of a high degree of swelling when wet in water.

Types of regenerated cellulose similarly can be used to control bleeding. It has been used as a surgical and dental purposes, proving to be effective in controlling capillary, venous and small arterial bleeding in various settings.



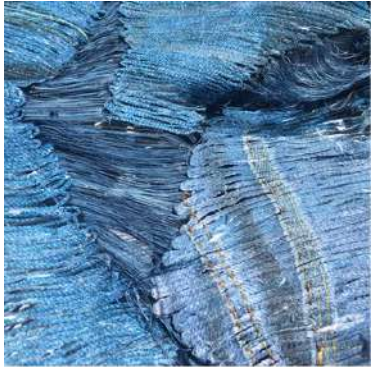
Microscopic images showing the anatomy of wood from a birch and beech tree. The cellulose fibres from the wood of these types of trees along with eucalyptus and spruce are used for the production of lyocell.



It is actually very interesting to see the cell and fibre structures in wood. While studying the chemical make up of cellulose found in wood, I wanted to look into the anatomy of these formations as well and use these for design inspiration.

Structural pattern in Design

The work of designers **Miette Farrer** and **Jennifer Davies** really fascinated me because of their use of texture, delicacy in the formation of their work, pattern and the union of structural elements in their pieces. Their intricate designs could also resemble the linear and organic patterns of wood fiber or cellular structures which I thought is really stunning.



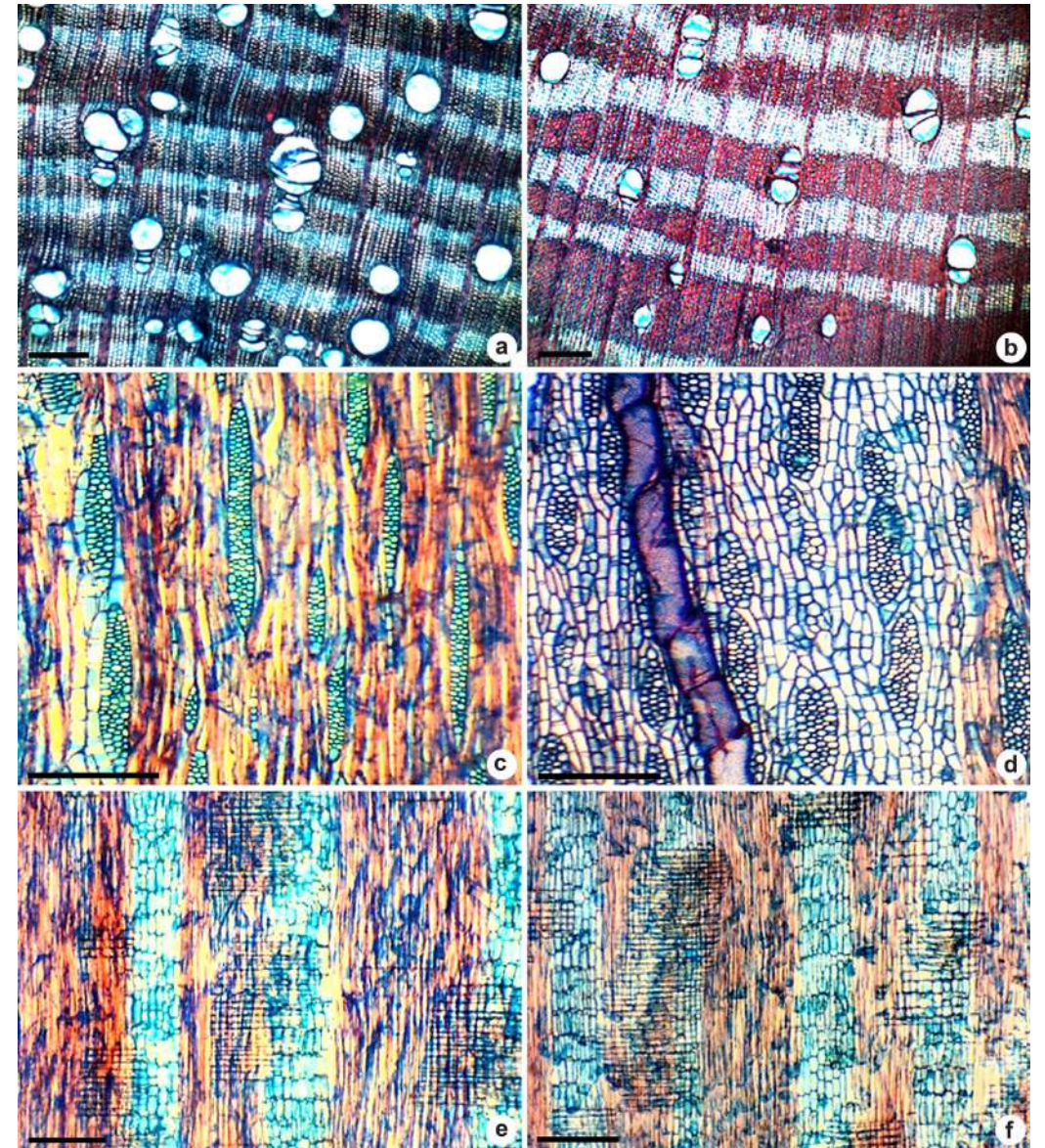
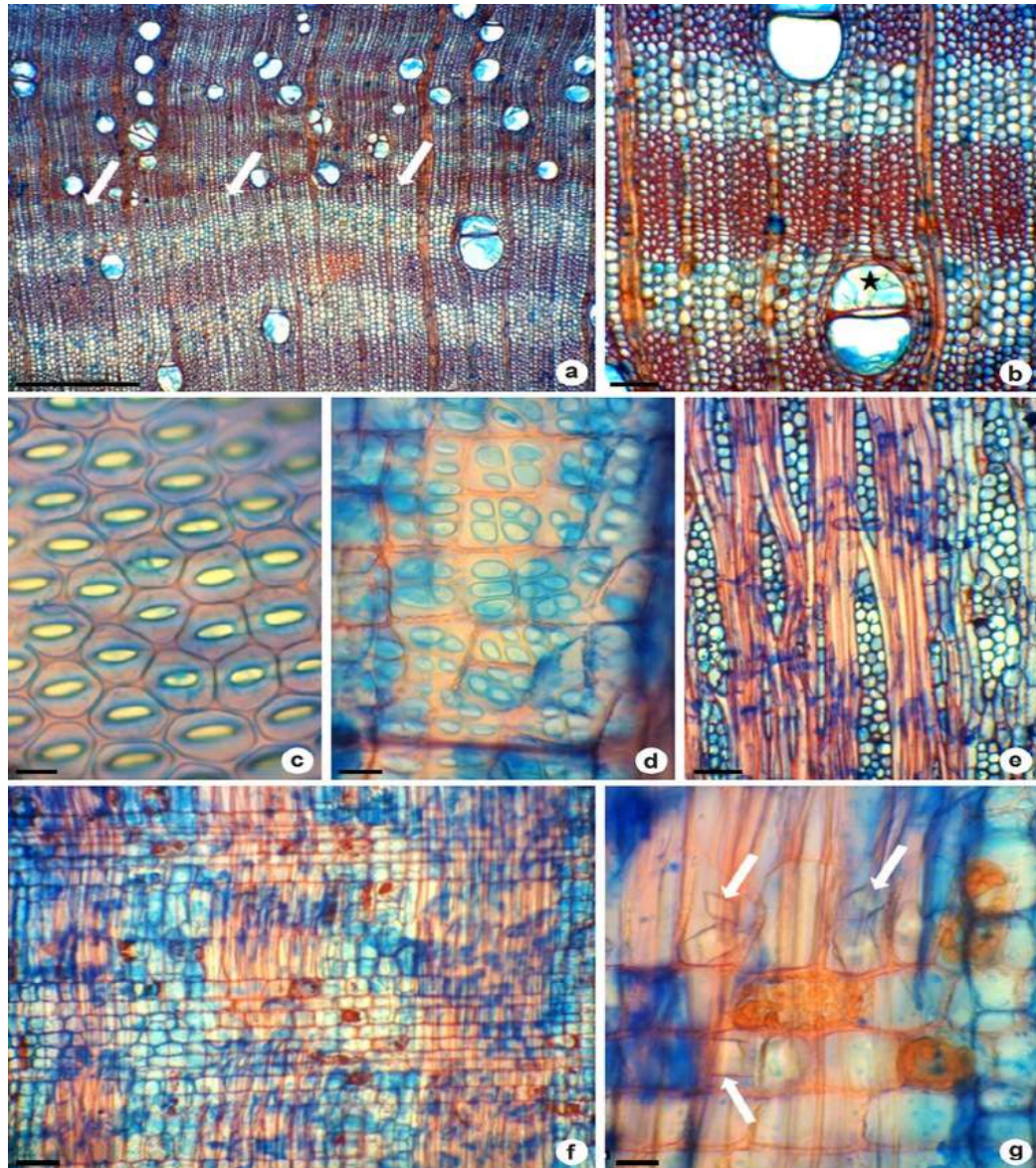
Miette is a textile and embroidery artist. Her work focuses on experimental techniques to create sculptural embroidery pieces, both wearable and non-wearable, using a wide range of textile techniques to appreciate slow craft and sustainable practice.

Her collection aims to create a balance between the delicate and the structured, the romantic and the bold. The nature of these statement pieces blur the line between fashion and art.



Davies has always been attracted to all forms of fiber, she starts with an idea, then gives herself over to a process that is intuitive, and at the best of times, playful.

Her sources of inspiration and pattern is derived from nature such as cracked rock walls, delicate spider webs, and the phases of the moon. Along with these references she aims for her work to have a strong physical presence that expands into multiple associations.



Looking at other microscopic images of wood/cellulose - looking at structural patterns, layers, texture and striking colour

Colour and Tactility

As I want to create a cover design mainly for children with eczema I must take my pattern, colour palette and texture into consideration.

I want to create a subtle design, one that does not attract too much attention as it will be a slipcover that will be visible under clothing or possibly a school uniform, but at the same time I wish to create a playful, cheery pattern inspired by cellulose formations due to the soft, organic shapes and structures shown through microscopic images. As stress and anxiety are one of the several triggers for eczema, I want to use a combination of calming, muted tones of blue and a deep purple or perhaps a peachy orange as these colours can be associated with relieving stress, are playful, young and are gender neutral. Tactility can also play an important role in stress relief as tactile stimulation triggers oxytocin, known as the love hormone which helps in reducing anxiety and stress. The outer feel of my covering could be a soft, fuzzy and calming texture to sooth stress or perhaps have a very lumpy, textured surface so the touch would distract the user from their stressful thoughts.

These are ideas I am still working on however; I would love to experiment with a bit of everything just to explore different design challenges and produce different outcomes for my piece to conclude which designs are most efficient.



Looking at calming and cheerful colours for relieving stress and anxiety



The tactility of fabric can also play a role in relieving stress

