

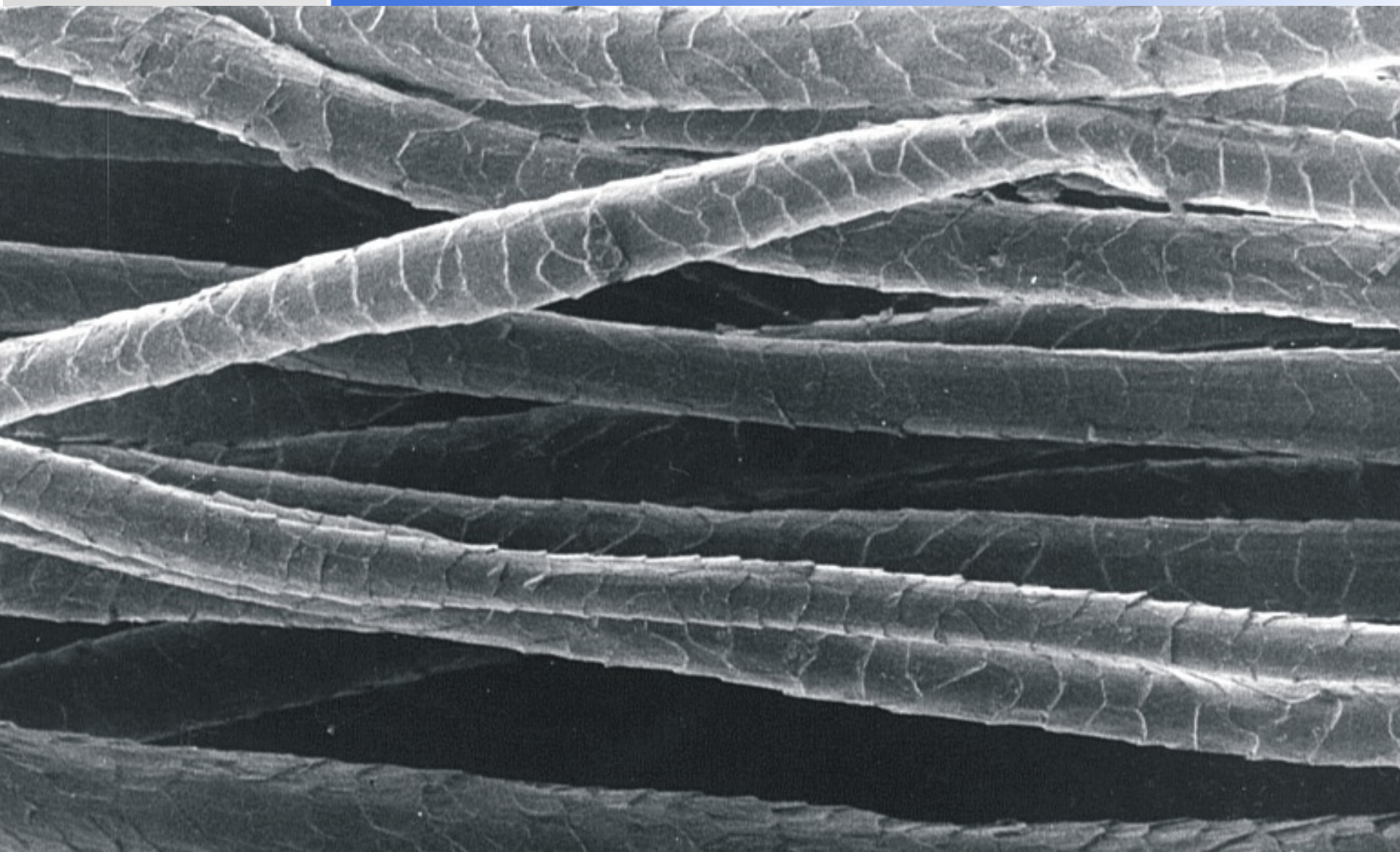
The wool fibre and its applications

Dr Geoff Naylor
CSIRO

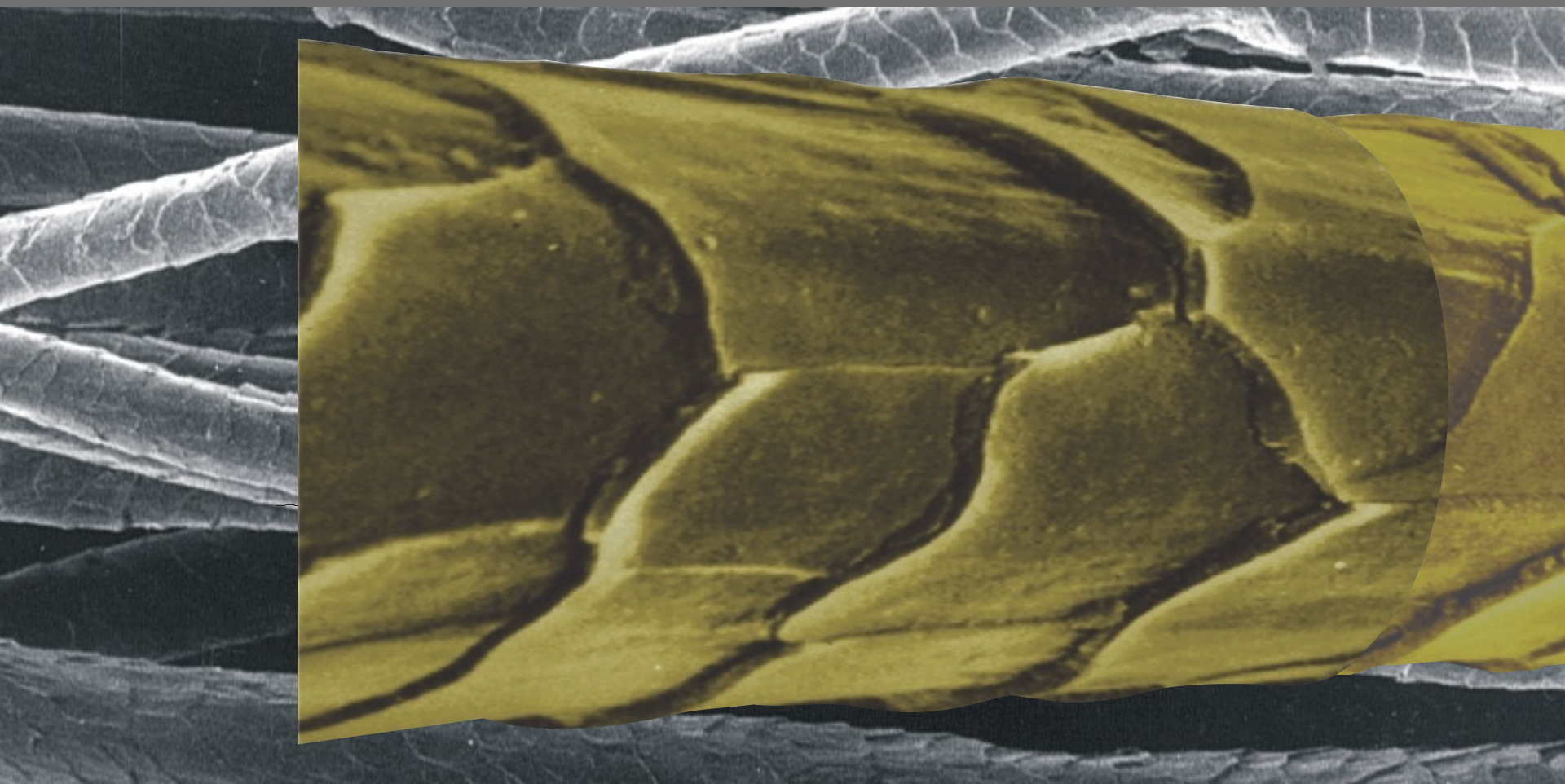
This lecture

- Introduction to the fascinating world of the wool fibre and its wonderful structure, which results in its many splendid properties.
- Start with a close look at the fibre.



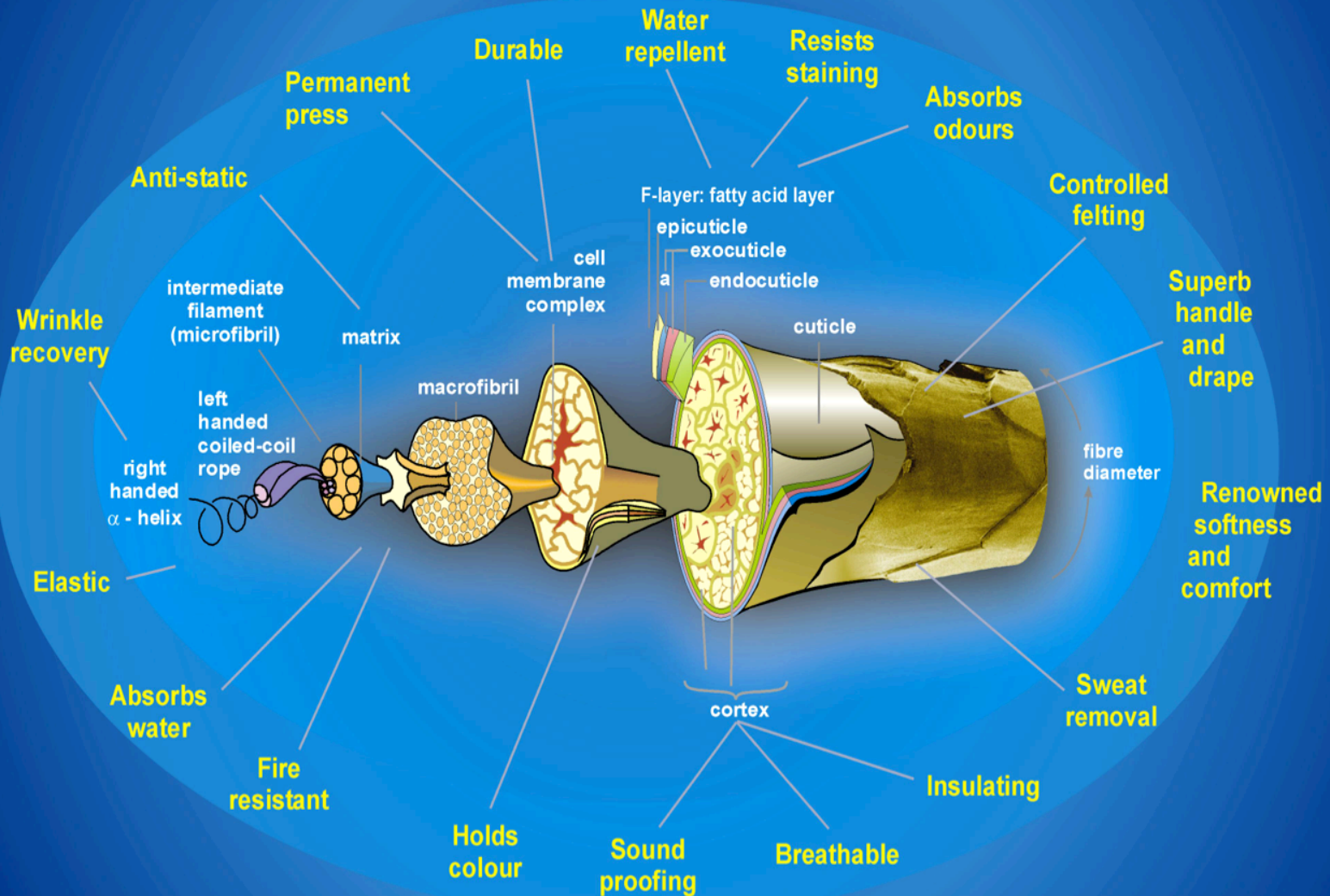


Wool Structure: not just a 'soup' of wool molecules



WOOL

THE FIBRE OF THE GODS - CREATED, NOT MAN-MADE



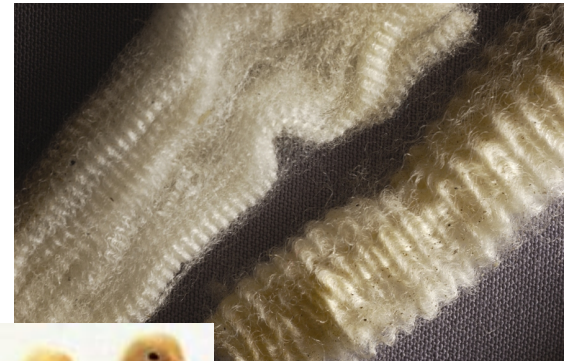
Warmth

- In cold environments an important function of textiles is to keep the body warm.
- Clothing reduces the rate of heat loss from the body.
- This physical property is called thermal insulation.



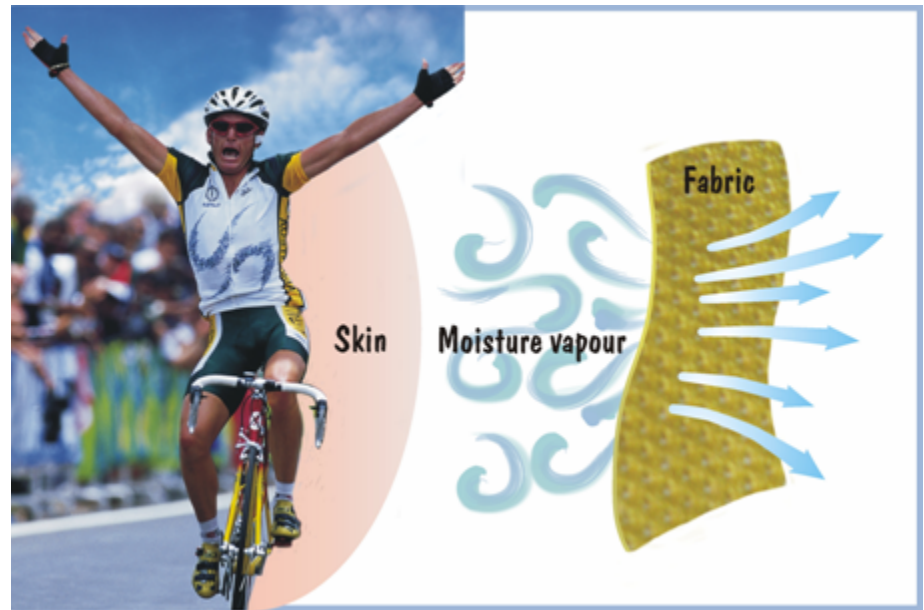
Warmth

- Still air is nature's best insulator – much better than any fibre.
- It is the air or spaces in textiles that give warmth.
- Wool's natural crimp and high bulk means it naturally traps lots of air. Hence it is famous for warmth, particularly in bulky knits.



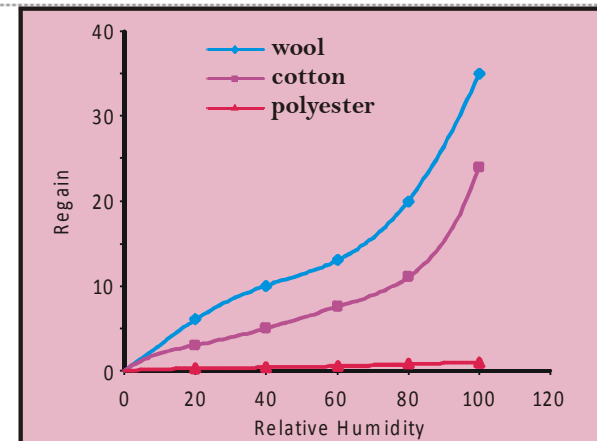
Wool: naturally absorbs water vapour and is breathable

- Wool is an active fibre.
- It is able to absorb and desorb moisture vapour as conditions around it change.
- This gives wool its fantastic 'comfort' properties and makes it 'breathable'.



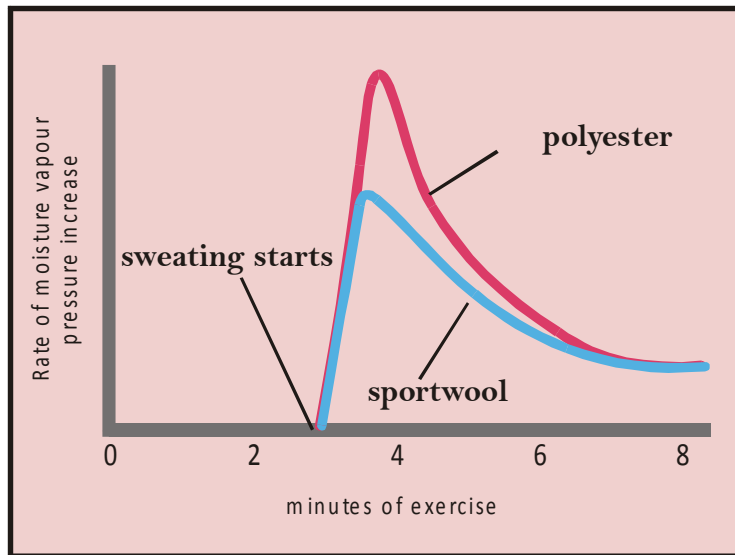
Wool: naturally absorbs water vapour and is breathable

- Scientifically, the amount of water a fibre can absorb internally, i.e. without feeling wet, is called its 'regain'.
- This depends on the relative humidity of the surrounding air.
- Wool comes first in this comparison, being able to absorb up to 35% of its weight in water before feeling wet.

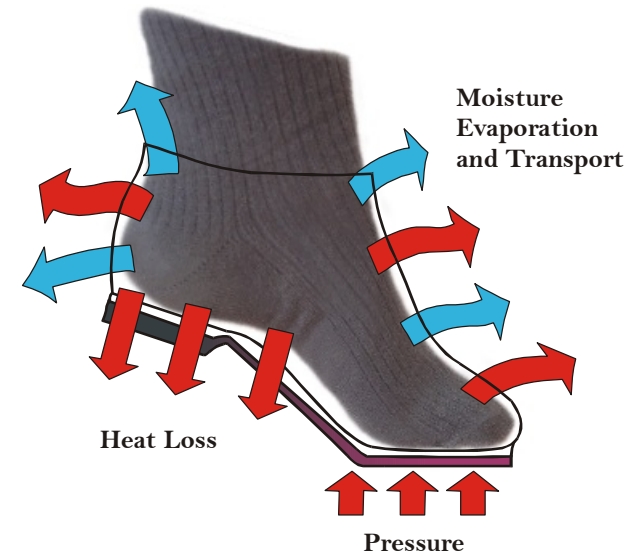


Fibre	Saturation regain%
Wool	35%
Cotton	24%
Polyamide	7%
Polyester	1%
Polyolefin	.05%
Polyacrylonitrile	7%
Aramid	6.5%

Wool: naturally absorbs water vapour and is breathable

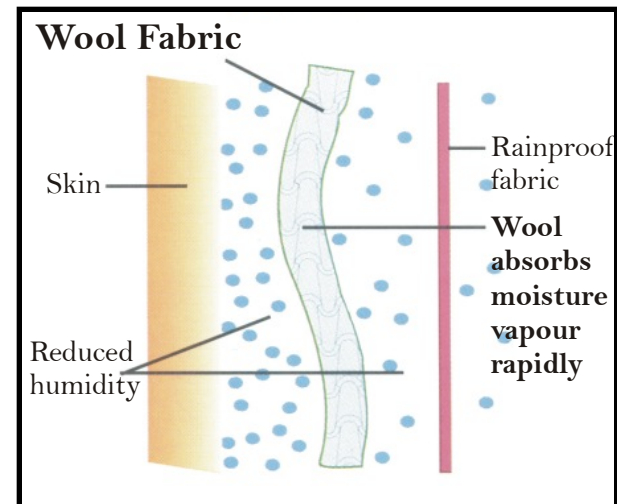
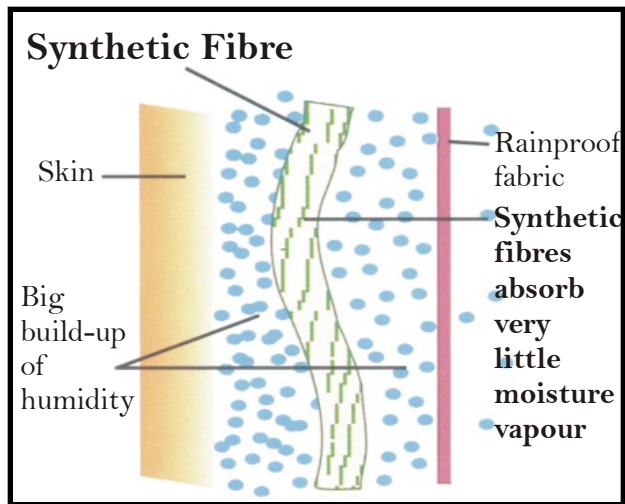


- The human skin is very sensitive to very small changes in temperature and humidity in the microclimate next to the skin.



- During physical activity wool can significantly reduce feelings of dampness and moisture discomfort.

Wool: naturally absorbs water vapour and is breathable



Wool is hygroscopic which means it can easily absorb water vapour. This property counteracts the build-up of clammy, humid conditions within clothing.

Active heating

- When wool absorbs water it actually generates heat!
- The amount of heat can be quite significant. When a kilogram of dry wool is placed in a moist environment the amount of heat it releases is about the same as an electric blanket running for eight hours.
- This active generation of heat is unique and can reduce ‘thermal shock’ during the transition from indoors to outdoors in wet winter climates.



Wool: water repellent

- As well as absorbing moisture vapour, the surface of the wool fibre naturally repels water. Small drops of water do not readily soak into a wool fabric but stay on the surface as droplets, which can easily be shaken off.
- This is great for outdoor clothing, such as golf wear.



Wool: water repellent and anti-soiling

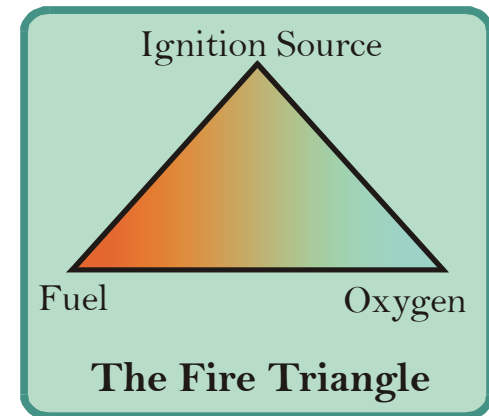


and spills on
wool carpets.



Wool – naturally flame resistant

- Fuel, heat and oxygen are all essential for combustion. Remove one and the fire extinguishes.
- Wool contains high levels of nitrogen and sulphur, which are natural fire retardants, i.e. hard to ignite.
- A natural black char forms, creating an insulating layer separating the fuel and oxygen.



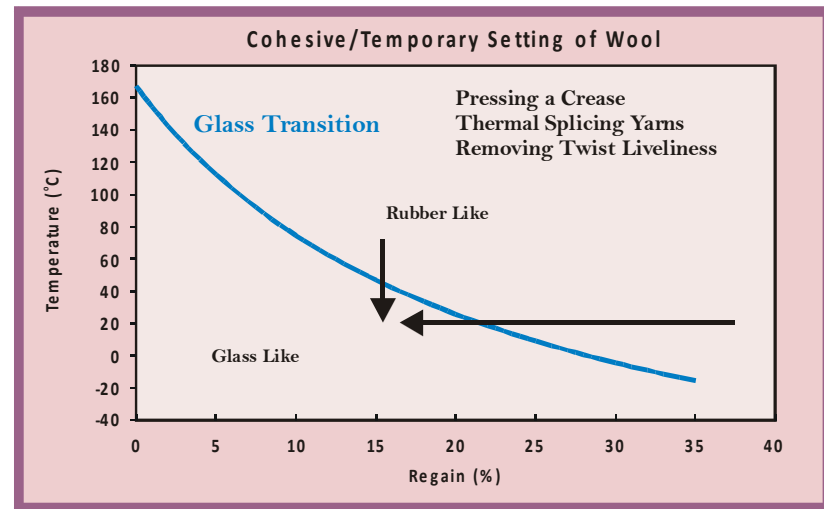
Wool: shape retention

- Wool has excellent tailorability, drape, style and shape retention.
- It can be shaped and set in a multiplicity of ways; for example, the three-dimensional shapes required for a suit.



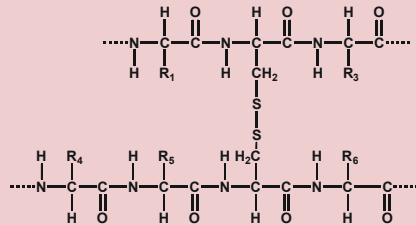
Wool: shape retention

- Depending on temperature and water content (regain) wool can be (i) stiff or 'glass like' or (ii) softer or 'rubber like'.
- This is used in tailoring to form and lock in the required shape.

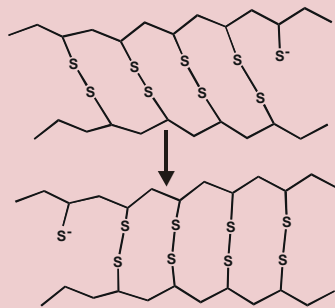


Wool: shape retention

Permanent Setting of Wool



The wool fibre contains a number of

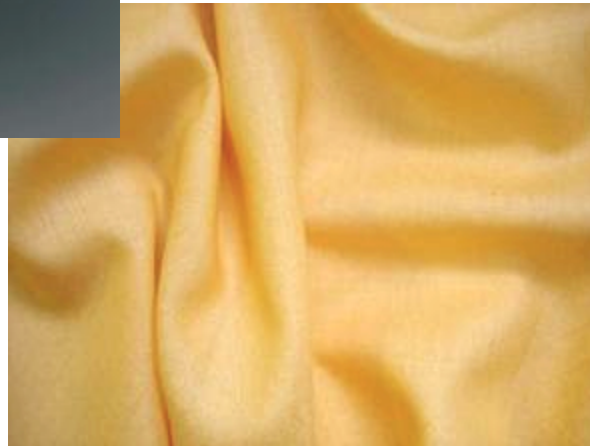


When the fibre is under stress, the disulfide bonds can rearrange

- Permanent creases can be achieved by rearranging the internal bonds in the wool fibre.



Wool: exquisite drape

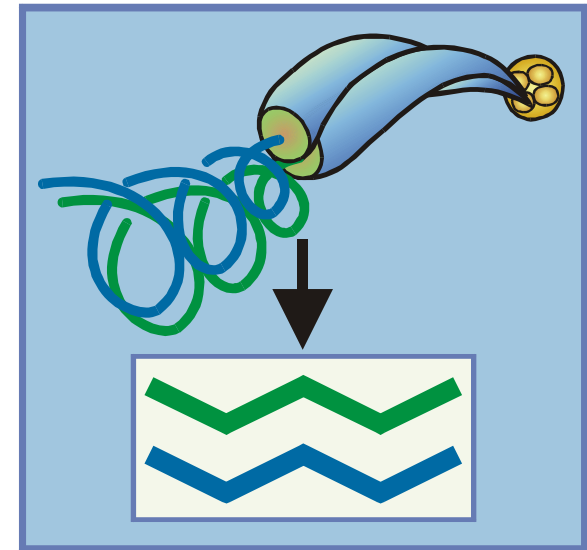
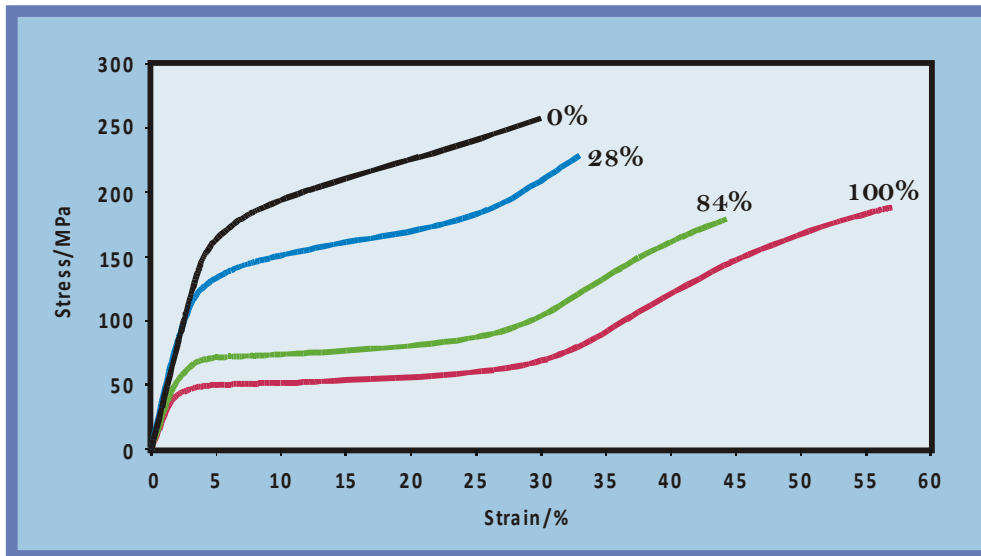


Elasticity



Elasticity

- Wool wears well not because of its strength but because of its high extensibility. This allows wool to stretch and recover with minimal breakage or damage.



Odour absorption



Wool shirt



Synthetic shirt

- Sweating is the body's natural way to regulate its temperature.
- If sweat remains on the body for several hours, bacteria can develop and lead to body odour.



- The moisture absorbing nature of wool and its breathability helps control this.

WOOL

THE FIBRE OF THE GODS - CREATED, NOT MAN-MADE

