CHARLES MACINTOSH

WHAT DID PEOPLE ALREADY KNOW?

Lots of different materials could be used to keep dry – e.g. oiled silk and waxed clothes.

WHAT DID THE SCIENTIST NOTICE?

There were problems with making materials both waterproof and comfortable.

WHAT QUESTION DO YOU THINK THE SCIENTIST ASKED?

How can I easily make material waterproof?

WHAT DID THE SCIENTIST DO?

Macintosh brushed different substances onto cheap cotton and compared how waterproof the materials were.

WHAT DID THE SCIENTIST FIND OUT?

Putting rubber between two layers of cotton was the best method to create waterproof cloth.

WHAT DID OTHER SCIENTISTS DO NEXT?

Scientists have developed modern materials, some which have 'smart' properties. Others are trying to design invisible cloaks.

WHAT WOULD YOU DO NEXT?

THE TIMELINE OF A RAINCOAT

30,000 YEARS AGO

Animals, birds and insects have evolved to stay warm and dry. Humans also need to stay warm and dry to survive. They do this by using combinations of insulating furs, plant materials and even animal intestines. We can learn much from looking at how indigenous people kept warm and dry. Vegetable fibres were used widely for homes and clothing for protection from the rain.

PRE–1800s

The Aleut American Indians needed a totally waterproof jacket for hunting in their kayaks. They used dried seal or whale intestines and sealed the seams with animal glues. To check how waterproof they were, the Aleuts would tie off the cuffs and neck and fill them with water.

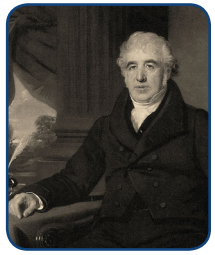
300 AD – 1800s

The development of waterproof, windproof, breathable textile fabrics began with silk and wool in ancient civilisations and continued with cotton and linen in the 19th and 20th century. Oiled silk is strong, waterproof, windproof and extremely light and was one of the first high performance fabrics. It was first used in umbrellas by the Chinese over 1000 years ago and vegetable oil was used on silk up until the 19th century.

1800s

Waterproof clothes were needed for outdoor work of all kinds, from sea-faring, to farming, for the military, for riding and for driving horse-drawn transport, as well as for sports. Many of the early solutions came through trial and error, using materials that came to hand, such as treating heavy duty sail cloth with linseed oil and a mix of other waxes to make weatherproof capes.

1823

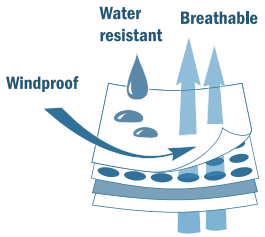


In 1823, at his factory of fabric developments, Charles Macintosh invented a double textured fabric sandwiched around a layer of rubber. This was developed into the first patented waterproof jacket.

1920s

Although the Macintosh coat was **lightweight** and **waterproof**, it was very uncomfortable and potentially dangerous for energetic sports such as mountaineering. It could also be damaged by salt and sweat. The Burberry jacket was created as a direct response to Macintosh's development. The fabric was lightly waxed and had gaps for self-ventilation. Because of its lightness and wind and snow resistance, Burberry jackets were used by polar explorers including Nansen, Amundsen, Shackleton and Scott and on the 1920s Everest expeditions.

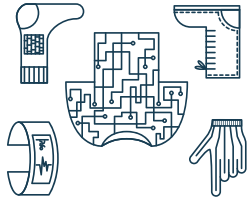
1969 / 2011



Scientists continued to develop new materials and fabrics for different sports. These include Gore-Tex and Voormi, which are often used to make coats today.

CURRENT

'SMART clothing' is made from fabrics that enable digital components, such as a battery, light or small computers and electronics, to be embedded in them.



THE TIMELINE OF A RAINCOAT

30,000 YEARS AGO

How do animals keep dry without coats?

Natural oils and insulating fur keep them warm and dry.

How did humans in the past use nature to help them keep dry?

Vegetable fibres were woven for use in homes and clothes and animal furs were also used.

PRE–1800s

How did Aleut American Indians keep waterproof when they went hunting in their kayaks?

They used dried seal or whale intestines and sealed the seams with animal glues. To check how waterproof they were, they would tie off the cuffs and neck and fill them with water.

300 AD – 1800s

How did waterproof, windproof, breathable textiles develop?

Oiled silk is strong, waterproof, windproof and extremely light. Vegetable oil was used on silk up until the 19th century to make fabrics waterproof.

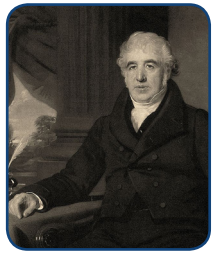
1800s

How did waterproof clothing develop for different jobs and sports?

Farmers, soldiers, horse-riders and sportsmen needed different coats.

Materials such as heavy duty sail cloth were treated with linseed oil and a mix of other waxes to make weatherproof capes.

1823



How was a comfortable waterproof jacket designed?

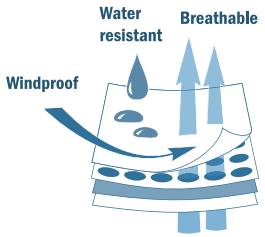
Charles Macintosh invented a double textured fabric sandwiched around a layer of rubber.

1920s

What was wrong with the first Macintosh coat?

it was very uncomfortable and potentially dangerous for energetic sports. It could also be damaged by salt and sweat. Burberry made a coat that was lightly waxed and had gaps for ventilation. It was used for sledging overalls by polar explorers including Nansen, Amundsen, Shackleton and Scott.

1969 / 2011



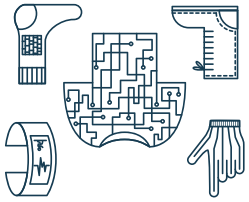
What type of waterproof fabrics do we use today?

Scientists have continued to develop new materials and fabrics for different sports. These include Gore-Tex and Voormi.

CURRENT

What will coats be like in the future?

SMART clothing with computers and lights will be able to help us to pay for things, see each other in the dark and play music for us.



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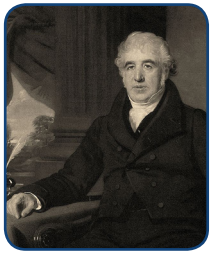
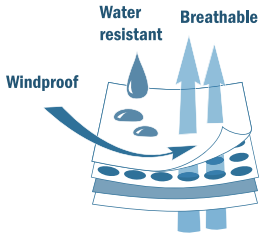


How did Macintosh design his waterproof jacket?

1969 / 2011



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PRE–1800s

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How was the first Macintosh coat improved?

CURRENT

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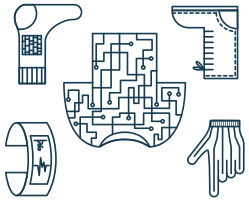
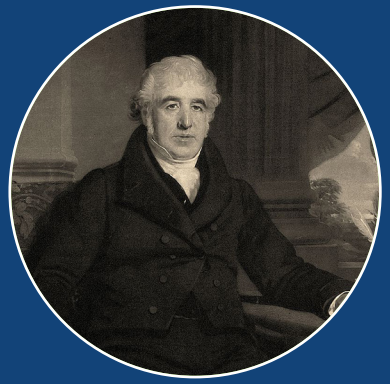




THE JOURNEY OF YOUR RAINCOAT

We are going to learn about Charles Macintosh and how he made a raincoat.

We will be creating and testing materials that could be used to make a raincoat, like Charles Macintosh.

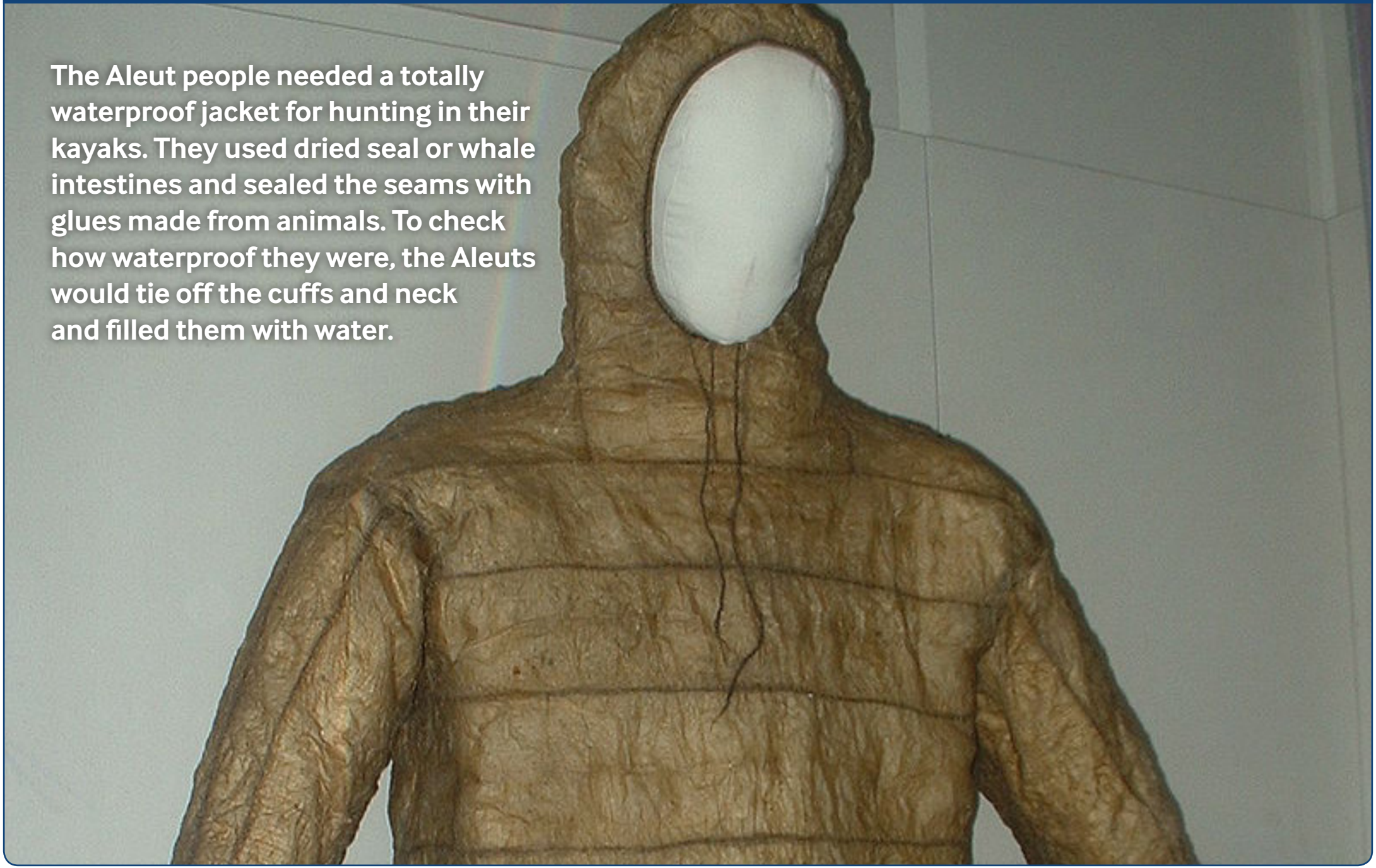
VOCABULARY

PROPERTY
MATERIAL
WATERPROOF
ABSORBENT
OBSERVE
RECORD

WHAT DID PEOPLE ALREADY KNOW?

Animals, birds and insects have adaptations to help them stay warm and dry. Human survival relies on staying warm and dry. People used a mixture of fur, plants and even animal intestines to do this.

WHAT DID PEOPLE ALREADY KNOW?



The Aleut people needed a totally waterproof jacket for hunting in their kayaks. They used dried seal or whale intestines and sealed the seams with glues made from animals. To check how waterproof they were, the Aleuts would tie off the cuffs and neck and filled them with water.

WHAT DID PEOPLE ALREADY KNOW?

The development of waterproof fabrics began with silk and wool and continued with cotton.

When silk is covered in oil it is strong, waterproof and light. It was first used in umbrellas by the Chinese over 1,000 years ago.

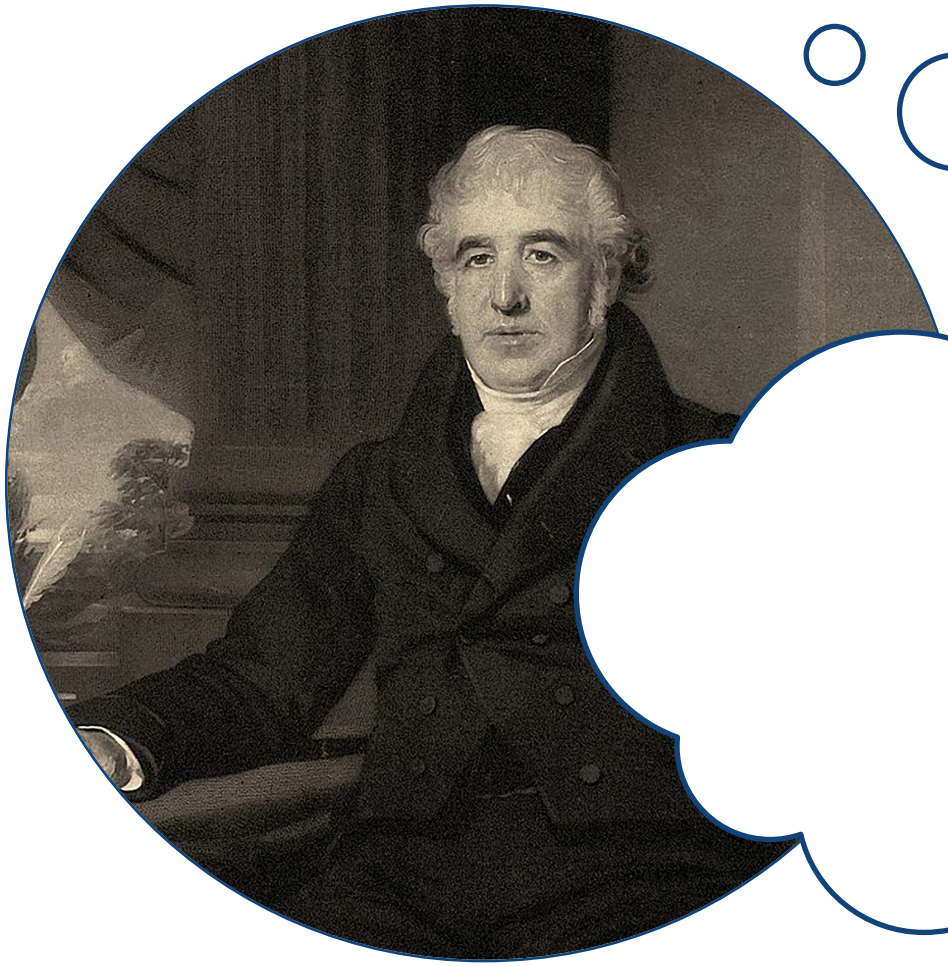
WHAT DID THE SCIENTIST NOTICE?

Waterproof clothes were needed for all kinds of outdoor work such as farming, military, and sport.

Many of the first waterproof clothes came from trial and error, using materials that were painted with oil or waxes to make waterproof capes.

Make a list of all of the reasons you might need waterproof clothing or waterproof materials.

WHAT QUESTION DO YOU THINK THE SCIENTIST ASKED?



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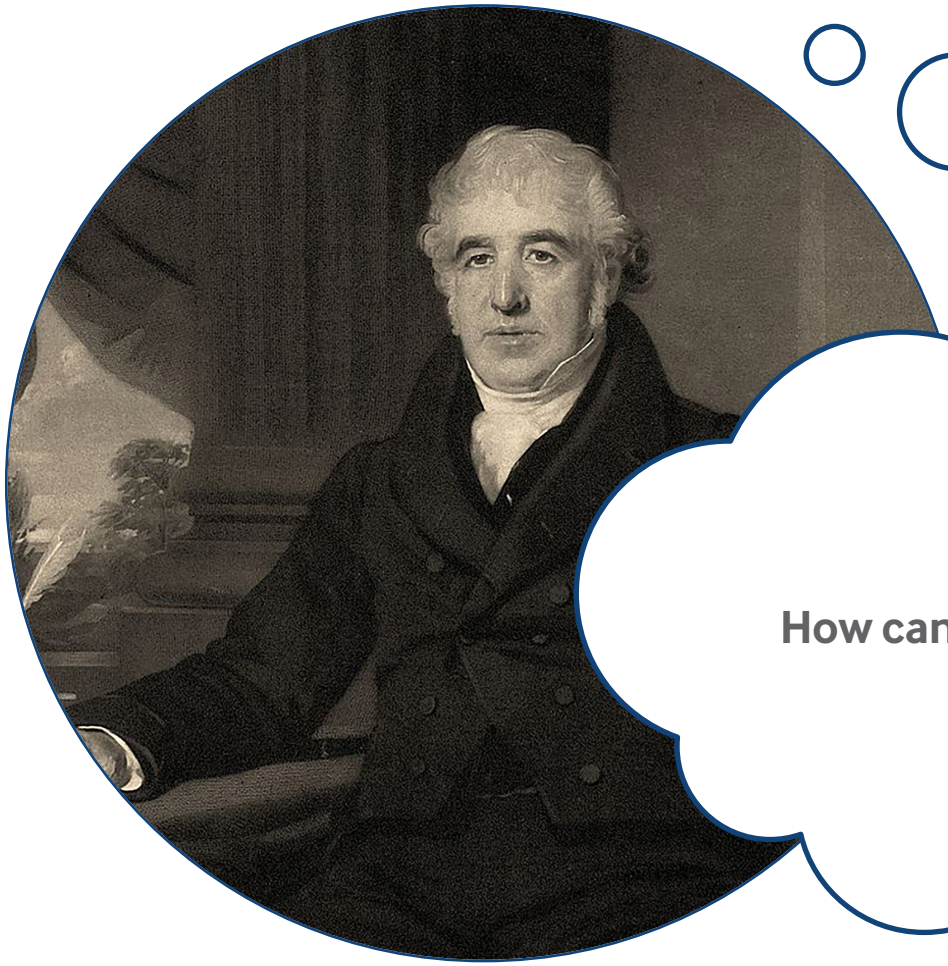
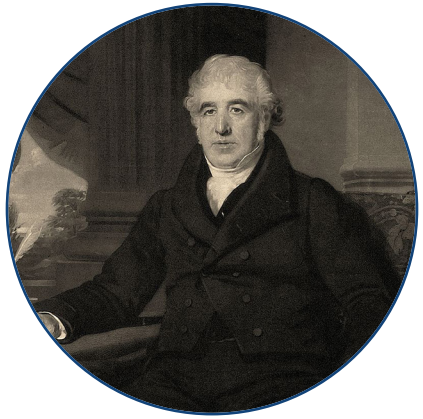


How can I easily make a material waterproof?

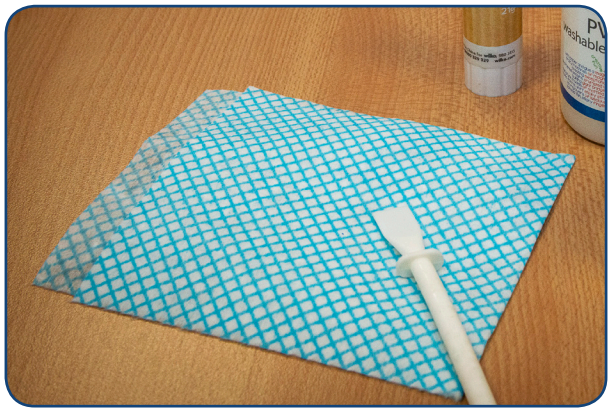
WHAT DID THE SCIENTISTS DO?



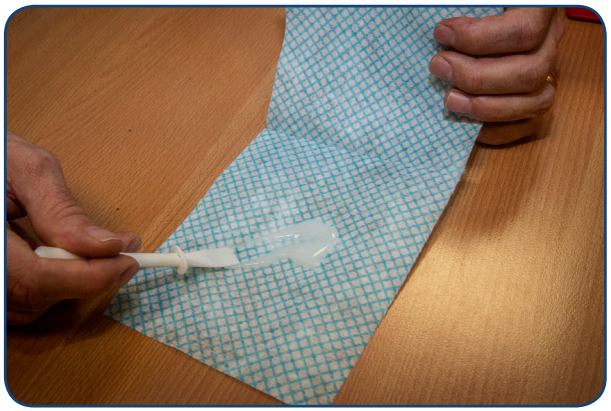
In 1823, in his factory of fabric development, Charles Macintosh invented two layers of fabric sandwiched around a layer of rubber.

This was developed into the first waterproof jacket.

WHAT WILL YOU DO?



1. Measure and cut out two squares of fabric about 15cm x 15cm.



2. Paint a layer of each substance onto the top of one of the layers. Place the other square of fabric on top to make a sandwich and wait until this dries.

3. Put each fabric sandwich over a plastic beaker and secure with an elastic band.

4. Pour the same amount of water over each fabric and measure how much water goes through.

WHAT WILL YOU DO?

FABRIC SANDWICH	Results / Observation
Cotton with 'solid glue stick' glue layer	
Cotton with PVA glue layer	
Cotton with oil layer	

Why not try out some of your own combinations?

WHAT DID THE SCIENTIST FIND OUT?

Macintosh discovered that by putting a thin layer of rubber between two layers of cotton, a waterproof material was made.

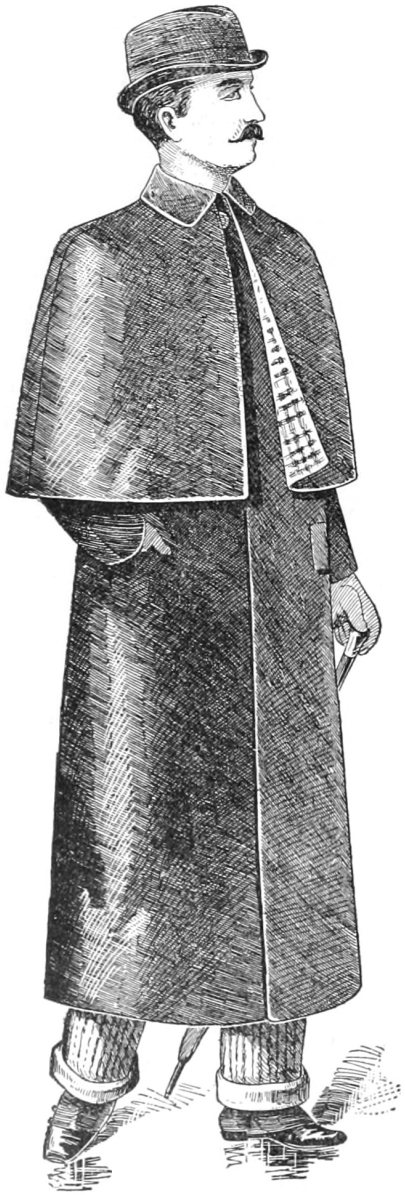
Why did this not make the perfect raincoat?

What did you find out?

Which layer was 'best'?

How do you know?

What might be the problems wit the waterproof materials you have created?



WHAT DID OTHER SCIENTISTS DO NEXT?

Although the Macintosh coat was **lightweight** and **waterproof**, it was very uncomfortable and sweaty!

Burberry invented a coat that was waterproof but also had sections that allowed sweat to come out.

Polar explorers including Nansen, Amundsen, Shackleton and Scott used Burberry coats on their Everest expeditions.

WHAT DID OTHER SCIENTISTS DO NEXT?

Voormi

(An incredibly thin material that is also waterproof)

Gore-Tex

Gore-Tex has a layer of human-made material which is waterproof and breathable.

Scientists develop new materials and fabrics for different purposes

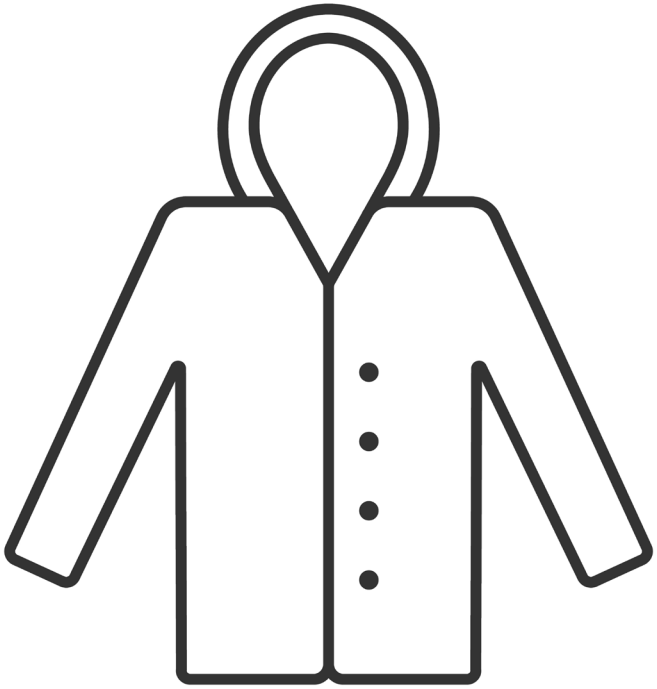
Intelligent clothing

- Inbuilt computers
- Lighting
- Music

WHAT ARE CURRENT SCIENTISTS DOING?

Natalie Von Götz, a chemist from the Swiss University EHT Zurich, has been studying nanoparticles in clothing. Nanoparticles are extremely small particles that have special properties. Increasingly, these are used as coatings on clothing to make it waterproof, microbicidal, UV-blocking or antistatic.

WHAT WOULD YOU DO NEXT?



What type of coat would you like to invent?