Forensic detectives
Suitable for: 11–16 years

Curriculum and learning links:
Separating mixtures, analytical and forensic techniques, human variation

Learning objectives:
• Recognise variation in human fingerprints.
• Describe how chromatography can be used to separate pigments.
• Investigate the differences between synthetic and natural fibres.

Activities:

Opening activity

• Watch Clip 19
• Show the class the ransom note and ‘Kidnapped’ poster with a photograph of your head teacher attached. Set the context that your head teacher has been taken hostage and that the class will need to complete three activities to identify which of the three suspected teachers is the culprit.
• Tell students that the fingerprints and clothing fabric samples of each suspect have been taken as evidence, as well as the pens found in their pockets. They will compare these with fingerprints and fabrics found at the scene and the ink in the ransom note.
• Make sure that you have permission from any staff members that you choose to involve in this lesson before you start.

Development activities

The following three activities can be completed in any order or simultaneously in a circuit. Students can use the Crime Scene Investigation Log worksheet to track the progress of their investigation throughout the lesson.

Fingerprinting

• Give students the Fingerprinting worksheet and ask them to identify the fingerprints at the bottom of the page.
• Explain to students that they will now investigate and classify their own fingerprints. Ask students to use soft pencils or charcoal to colour in their fingerprints and transfer them to the sticky side of sticky tape strips. These can be stuck onto the Crime Scene Investigation Log worksheet.
• Ask students to compare the fingerprints of the three suspected teachers with that of the kidnapper. Allow students to rule out one teacher for having the wrong type of fingerprint. They can record the results on the Crime Scene Investigation Log worksheet.
Development activities continued...

Chromatography

- Watch Clip 20.
- Show students the pre-prepared example of a chromatogram with one type of black ink separated into components and explain that this was the ink used on the ransom note.
- Ask students to complete the chromatography test as shown in the video clip using a variety of black, water-soluble pens taken from the suspected teachers. Full details of this activity can be found with the Forensic Detective film at: bbc.co.uk/bang/handson
- Students can attach their finished chromatogram to the Crime Scene Investigation Log worksheet.

Microscopy of fabric samples

- Show students how to make microscope slides by putting fabric fibres onto a small drop of water underneath a cover slip.
- Explain to students how microscopes work and ask them to draw images of different natural and synthetic fibres (e.g. wool, cotton, nylon and silk) from what they see under the microscope. If you don’t have access to microscopes you could show students the microscopic images of fabric samples on page 40 of this pack.
- Encourage students to compare their samples with the fabric found at the crime scene to rule out one teacher.

Reflect and review

- Students should bring the results of their three investigations together to identify which teacher is the culprit. You could ask them to write this up in a forensic-style report or present their findings to the class by role-playing forensic officers giving evidence at a trial.
want to explore further?

• Students could use aluminium powder to investigate shoe patterns as shown in Clip 19. If you don’t have aluminium powder, this activity could be completed using the soft pencils or charcoal used in the fingerprinting exercise.

• The Chromatography experiment could be extended by asking students to calculate Rf values or speed. Rf values are calculated by dividing the distance travelled by one of the pigments by the distance travelled by the solvent.

• The Microscopy experiment could be extended by asking students to look at different types of animal or human hair under the microscope.
You will need

- Clip 19 (7’13”)
- Clip 20 (2’58”)
- Fabrics Under the Microscope worksheet
- Crime Scene Investigation Log worksheet
- Fingerprinting worksheet
- Sticky tape
- Soft pencils or charcoal
- A variety of water-soluble black pens or ink
- Chromatography paper
- A range of fabric samples (e.g. wool, cotton, nylon, silk)
- Microscopes
- Slides and cover slips
- Pre-prepared fingerprints from three willing teachers, including a ‘culprit’ fingerprint
- Pre-prepared fabric samples, including a ‘culprit’ sample
- Pre-prepared chromatography sample
- A mock-up ransom note
- ‘Kidnapped’ poster with a photo of your head teacher
- Tap water
- Beakers

Technician’s notes

- You will need to make up the ‘evidence’ in advance. This will include a ransom note, a ‘Kidnapped’ poster with the head teacher’s photograph on it, a chromatogram from the suspect’s pen, fingerprints from three teachers and an extra sample from the ‘culprit’, and three fabric samples as well as the ‘culprit’s’ sample.
- Make sure that the pens you use for the chromatography are water-soluble.

Health and safety

- Normal laboratory guidelines apply for all three activities.
- Students should wash their hands after the Fingerprinting activity.
- Care should be taken with glass slides and cover slips in the Microscopy experiment.
- It is the responsibility of the teacher to ensure that an adequate risk assessment has been completed.
KIDNAPPED

Subject last seen in Staff Room

Attach photo here

PLEASE HELP
**Fingerprint**

Take your own fingerprints, stick them here and write down what type they are:

Now look at the kidnapper’s fingerprint.
- What type is it?
- Which suspect’s fingerprint matches this fingerprint type?

**Fabric samples**

- Make sketches of what the different fibres look like under the microscope and write down what fabric they are.
- Which suspect’s fabric matches most closely with the kidnapper’s?

**Chromatography**

- When your chromatogram has dried, stick it here.
- Which suspect’s pen matches most closely with the kidnapper’s?

**I think the kidnapper is:**
There is a variety of systems used to classify fingerprints. In this lesson, we will try to identify eight types, as demonstrated by the diagrams below.

Plain Arch  Tented Arch  Radial Loop  Ulnar Loop

Plain Whorl  Central Pocket Loop  Double Loop  Accidental

Use this fingerprint guide to identify the fingerprints below. Can you see any similarities?
Fabrics Under the Microscope

- Silk
- Wool
- Cotton Polyester
- Silk