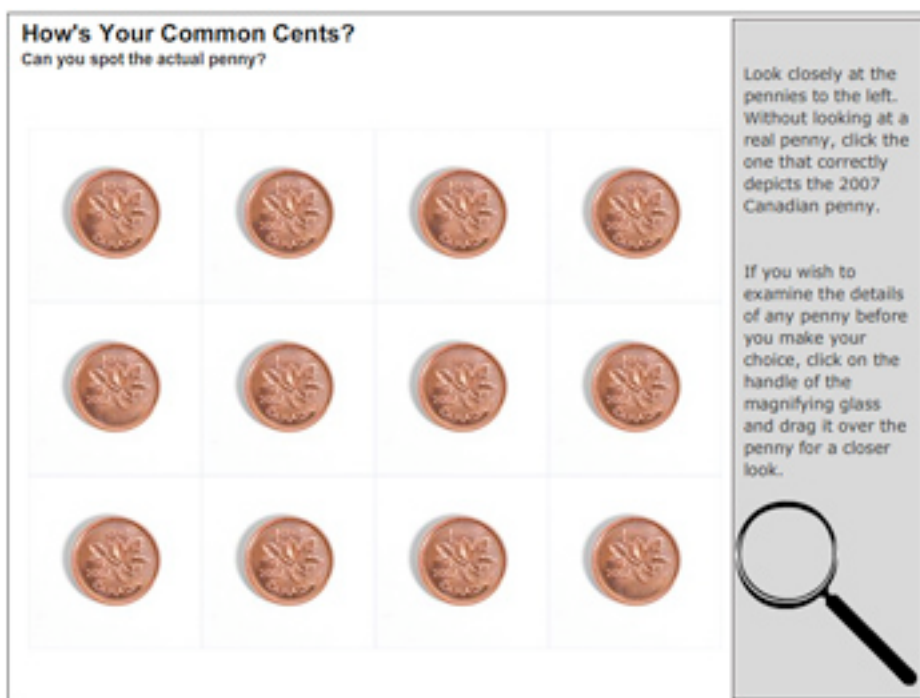


Name: _____

Block: _____

Forensics: Module 2

To begin this lesson, let's find out how good you are at noticing small details. Click on the image below to test what you know about the Canadian penny. Have fun! Click on the picture for a link to a better image online.



The Forensic Anti-counterfeiting Specialist

How did you do? Did you notice, for example, that the penny on the far right in the top row is missing the year? Or the penny second from the right in the middle row is missing the words 1 Cent? Did you spot the real penny?

Of course, pennies aren't the only objects that can be faked. Documents such as paper currency, legal contracts, passports, and driver's licenses are also at risk. This is where the forensic anti-counterfeiting specialist comes into the picture: a forensic anti-counterfeiting specialist can determine whether a document is authentic or if it is a forgery. This person can also determine who or what (i.e., what machine or type of machine) produced the document. A forensic anti-counterfeiting specialist can even analyze handwriting samples.



Brian Wainwright is a forensic anti-counterfeiting specialist at the RCMP Forensic Laboratory in Vancouver, BC. Watch the following short video clips to learn more about what Brian does:

- What Does a Forensic Anti-counterfeiting Specialist Do?

https://media.openschool.bc.ca/osbcmmedia/scitech11_v1/html/sct112b1v_bw_whatdoes.html

- Examining Handwriting

https://media.openschool.bc.ca/osbcmmedia/scitech11_v1/html/sct112b1v_bw_handwriting.html

Ink Analysis

Look closely at this cheque. Do you notice anything suspicious about it?



The number 6 and the word sixty don't look quite right - as if someone added them later. This cheque appears to have been forged, but how can we find out for sure?

A forensic anti-counterfeiting specialist like Brian Wainwright can use different methods to determine if this cheque is a forgery. For example, Brian might shine an alternate light source (such as a laser or an incandescent bulb) over the cheque. If the cheque has been forged then different inks will be visible at different wavelengths of light.

Another method Brian can use to "check the cheque" is Thin Layer Chromatography (TLC). Using this method, Brian dips samples of ink and paper from the cheque into a solvent. The solvent interacts with the ink then migrates up the paper, creating bands of colour. If two ink samples from the cheque produce different bands of colour then the inks are different. This would suggest that someone forged the cheque by adding information with a different pen. TLC is very effective for spotting forgeries. Unfortunately it destroys the original sample.

Activity – do this! (Ask me for the materials)

1. Find two washable black felt pens. Each pen needs to be a different brand to ensure the colour compositions are different.
2. Cut a strip of paper towel or a coffee filter for each pen.
3. Mark a black dot at the bottom of each strip.

One at a time, dip the strips in water. Dip to just below the dot. Hold the strip and allow the water to soak up the strip. Watch what happens to the ink. Do you see the different bands of colour?

Determining the Source

Brian might also be able to determine the specific machine used to produce a questioned document. To do this, he first examines the document under a microscope for identifying marks. These could be things like "scratches" on a photocopied document (caused by dirt or foreign material on the photocopier glass); impressions in the document caused by a chip in a laser printer drum; or a damaged key on a typewriter. Next, Brian attempts to find the machine with these same accidental characteristics. This will be the machine that produced the questioned document.

Activity: Questioned Documents

1. Give three examples of documents that might be sent to a forensic anti-counterfeiting specialist like Brian Wainwright.

2. Why are unique identifying marks, like scratches, important clues for a forensic anti-counterfeiting specialist?

3. What are two ways to analyze ink on a document?

4. How can either of these techniques help spot a forged document?

Handwriting Identification

A forensic anti-counterfeiting specialist like Brian Wainwright will also be called in to examine handwriting samples when there is doubt who the author is or when forgery is suspected. Brian will examine the questioned document carefully, looking for things such as the slant of the letters, the spacing between letters and words, the size relationships between letters, angles, connecting and ending strokes of letters, distinctive letter formations, and the overall flow of the writing. Brian will then compare the questioned document to a known standard to see if

they share common characteristics. If they do, Brian may conclude that the same person wrote both documents. If they don't match then there is a probable forgery.

A handwriting sample from a suspect can be a requested sample or a collected sample. If it is requested, then the suspect is asked to handwrite the exact wording found on the questioned document. A collected sample is a pre-existing piece of handwriting that is obtained from the suspect under police warrant, such as a grocery list, a letter, or a note.

Activity: Find the Forger

1. Two of these samples are written by the same person but the third is not. Which one is the forgery?

a.

Please excuse Roscoe from class at
2:30 today so he can attend a
family reunion
Sandy Roop

b.

Please excuse Roscoe from class at
2:30 today so he can attend a
family reunion.
Sandy Roop

c.

Please excuse Roscoe from class at
2:30 today so he can attend a
family reunion.
Sandy Roop

2. List three ways you can tell the sample is a forgery.

3. What is the difference between a collected handwriting sample and a requested handwriting sample?

4. *Skipping School*

The Alleged Crime: Jessica was absent last class and has brought you a sick note from her mother. You suspect the note is forged and that Jessica or one of her two friends in the class, Sandy or Leanne, wrote it. You've just asked your students to hand in their homework, so you have samples of the girls' handwriting to compare against the note.

- a. The handwritings on the girls' homework are your known handwriting samples. Would these be called requested or collected handwriting samples? Explain your answer.

- b. What would be the advantage of using these samples instead of asking the students to write something out for you?

d. What would be the disadvantage of using these samples?

You find an old note written by Jessica's mother, filed in the school office. Compare the handwriting in this note with the note handed in by Jessica (samples below).

June 26, 2008
Please excuse Jessica's absence
from class yesterday. She wasn't
feeling well.
Patricia Wong

Forged note

March 4, 2008
Please excuse Jessica from school
this afternoon. She has a doctor's
appointment.
Patricia Wong

Old note

You decide the new note is a forgery. Identify three differences between the notes that make you think this. Include specific differences such as shape/size of specific letters.

Compare each of these handwriting samples from the students' homework (next page) to the forged note from June 26th.

Decide which of these homework samples matches the forged note. From the match, who wrote the forged note?

Support your decision by pinpointing three characteristics that are common between the sick note and the samples. Give specific examples that are NOT present in the other samples. Use the samples from your lesson as guidance such as a difference in size/shape of specific letters.

3. Our sun is an intermediate mass star.
4. A supernova is the explosion of a high mass star.
5. After an extremely high mass star collapses on itself, it can become an extremely dense object known as a black hole.
6. A star's spectrum is the pattern of light the star emits once it has been split by a spectroscope.

Sandy's
homework

3. Our Sun is an intermediate mass star.
4. A supernova is the explosion of a high mass star.
5. After an extremely high mass star collapses on itself, it can become an extremely dense object known as a black hole.
6. A star's spectrum is the pattern of light the star emits once it has been split by a spectroscope.

Leanne's
homework

3. Our sun is an intermediate mass star.
4. A supernova is the explosion of a high mass star.
5. After an extremely high mass star collapses on itself, it can become an extremely dense object known as a black hole.
6. A star's spectrum is the pattern of light the star emits once it has been split by a spectroscope.

Jessica's
homework

Did Someone Forge Uncle Joyless's Will?

Instructions:

Cranky old Uncle Joyless recently passed away after choking on a chicken bone. In his handwritten will he left everything to his twenty-one-year old girlfriend who he met last month in Las Vegas. The family is angry and very suspicious. Did someone tamper with his will? Was it forged to cut the family out of the inheritance and give everything to the “gold-digger” girlfriend? The family hires you, a well-known document examiner, to study Uncle Joyless’ will in detail.

1. Describe two ink analysis techniques you might use to check if the will has been forged.

2. Describe the advantages and disadvantages of each technique. Do not include any handwriting analysis ONLY ink analysis

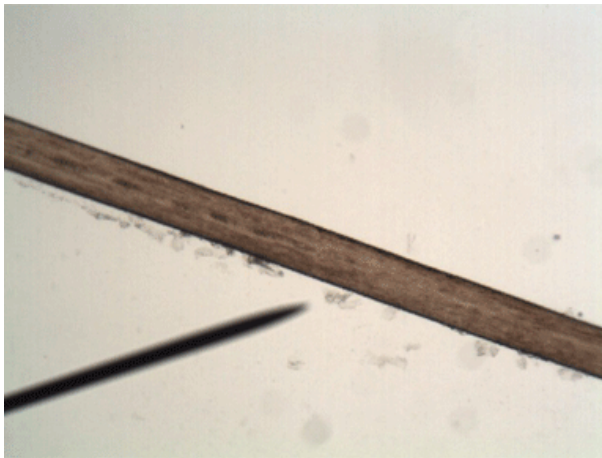
Hair and Fibre Analysis

Locard's principle of exchange states that every contact with another person or with an object leaves a trace. This means that at any crime scene there is evidence left behind that can help solve the case. This evidence can include hair and fibres.

Identifying Hair

One type of trace evidence often found at a crime scene is hair. After hair is collected it is sent to the lab for analysis. Here a forensic chemist studies it under a microscope. The first thing the forensic chemist does is determine if the hair is from a human or an animal. There are some general rules that apply here.

- If the hair is wider than 0.2 cm it is likely the outer hair, or guard, from a larger animal. If the hair is 0.2 cm or narrower, it could be human hair or hair from a smaller animal.
- If the medulla, or central core of the hair, measures more than $\frac{1}{3}$ the total width of the hair, it is most likely an animal hair. If it is less than $\frac{1}{3}$ the total width then it is probably a human hair.
- If the medulla has a ladder-like pattern it is an animal hair. If it has a continuous pattern with no ladders it is a human hair.
- If the scales on the hair have a variable pattern it is an animal hair. If the scales have a more symmetrical pattern (overlapping, like shingles on a roof) it is a human hair.



Human Hair



Animal Hair

Once the forensic chemist has determined a hair comes from a human, he can study it for other information. Sometimes the race can be determined. For example, if the hair is coarse, curly, and black and the medulla is broken then it could be from a person of African or African-American descent. If the hair is blonde and fine and the medulla is sparse, then the owner could be Caucasian. However because many people are of mixed racial background, their hair cannot always be identified so easily.

The Real Value of Hair Evidence in a Criminal Investigation

If a hair from a crime scene matches one retrieved from a suspect, it suggests the suspect was at the crime scene. However, it doesn't necessarily prove he committed the crime - only that he was there at some point.

To compare two hair samples directly, the forensic scientist will use a comparison microscope. A comparison microscope has two stages and two eyepieces. The left eyepiece shows what's on the left-hand stage, and the right eyepiece shows what's on the right-hand stage. When you look at them together through the eyepiece, you have a split screen, where half is the left side and half is the right side. This allows the forensic scientist to compare the samples on each slide.

Scientists can also determine if the hair was forcibly removed or if the owner was taking prescription medication or even illegal drugs. Using a technique called neutron activation analysis, forensic scientists can analyze the chemical makeup of a substance, like hair, for important clues.

Did You Know?

Napoleon Bonaparte was the Emperor of France in the early 1800s. Following his defeat at the Battle of Waterloo, Napoleon was banished to the island of St. Helena. He died there six years later.

One hundred and forty years after his death, forensic toxicologists tested a lock of Napoleon's hair using neutron activation analysis. This test revealed that Napoleon had high levels of arsenic, a poison, in his body. Some people suggested that Napoleon had been poisoned to death. This idea was rejected when toxicologists found equally high levels of arsenic in many other people they tested. Their conclusion? People in the 19th century were exposed to naturally high levels of arsenic in the environment.

Fibres

Often when a crime is committed, fibres are transferred from the suspect's clothing to the victim's clothing, and vice versa. If the identification officer finds fibres such as these at the crime scene, he or she will collect them using special adhesive tape. The identification officer will then send these fibres to a forensic chemist for analysis.



Rob Groves is a forensic chemist at the RCMP Forensic Laboratory in Vancouver, BC. One of Rob's duties is to determine whether fibres taken from the suspect's clothing match those found on the victim's clothing. If they do, this suggests that the suspect, or at least someone wearing the suspect's clothing, came into contact with the victim. It doesn't prove the suspect

committed the crime, but it makes it look likely.

Rob uses a microscope to look for fibres on the victim's clothing that are the same colour as those on the suspect's clothing. For example, if the suspect's shirt is red, Rob will look for red fibres on the tapings taken from the victim's shirt. If he finds any, Rob removes them very carefully using tweezers or forceps. He then places each red fibre on a separate glass slide. Rob then removes red fibres from the suspect's shirt and similarly mounts these on other glass slides.

Next, Rob compares the fibres samples using a comparison microscope. You learned what a comparison microscope is earlier in this lesson. This tool allows Rob to directly compare a red fibre sample from the victim's clothing with one taken from the suspect's clothing. If the two samples exhibit the same physical properties, Rob will do further testing.

To learn more about fibre evidence watch [The Value of Fibre Evidence](#).

https://media.openschool.bc.ca/osbcmmedia/scitech11_v1/html/sct111b1v_rg_evidence.html

Wayne Williams Case

From 1979 to 1981, thirty young black males were murdered in the Atlanta, Georgia area. Police suspected a serial killer but at first had no real suspects. Eventually their attention turned to a 23-year-old local named Wayne Williams.

With the help of forensic scientists, police were able to match fibres found on the victims with ones from the carpet in Williams' car and in his apartment. Williams' hair and his dog's hair were also found on several of the victims. Based on this evidence, Williams was convicted of the murders of two of the victims and sentenced to life in prison. He is believed to be responsible for the other murders as well.

Activity 1: Hair Analysis

1. Give four characteristics that can be used to distinguish animal hair from human hair.

2. Why is hair analysis questionable in court?

3. Identify two other uses of hair evidence.

4. Look at your own hair and an animal hair in the dissecting microscope or magnifying lens. Sketch each one below. What differences do you notice?

