EXPLORING FORENSIC SCIENTIFIC METHODS

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THE CASE

Sophia Bannow, a 22 month old child, was kidnapped from her mother in a Fairfield Stop & Shop last week. The next morning, Bannow was found underneath a table outside the Fairfield University Campus Center.

We will reveal what happened to Sophia Bannow in the 17 hours she was kidnapped, and *who is responsible*.

THE CASE

Physical Symptoms:
Lethargy
Twitching in arms and legs
Vomited 3X in hospital
Abdominal Pain
Yellow Sclera
Bluish tint to gums

Past Medical History:
Allergic to Amoxicillin
Eczema

THE CASE

Potential Leads:
- Two suspicious vans stopped
  - Drivers interviewed
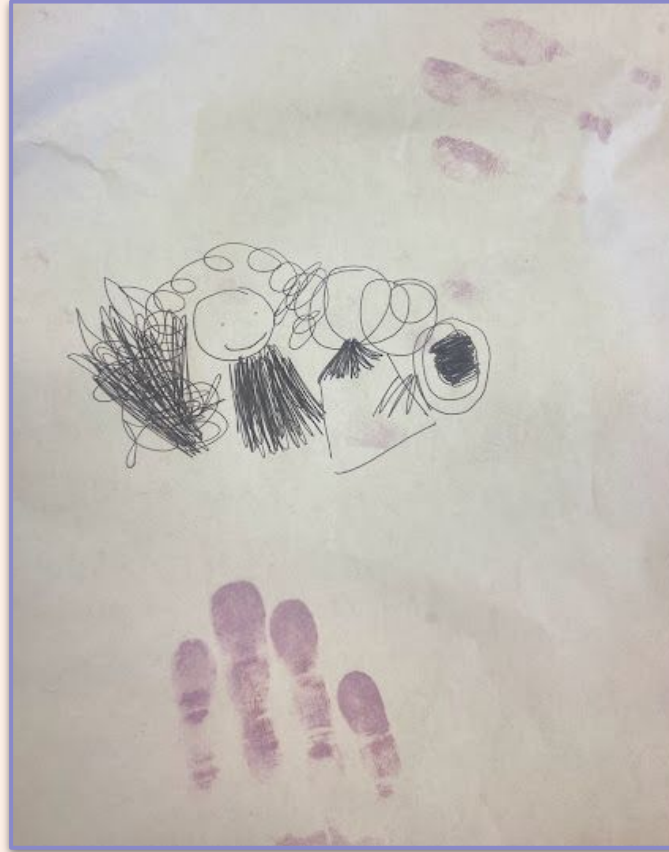- Physical evidence taken from vans

Potential Suspects:
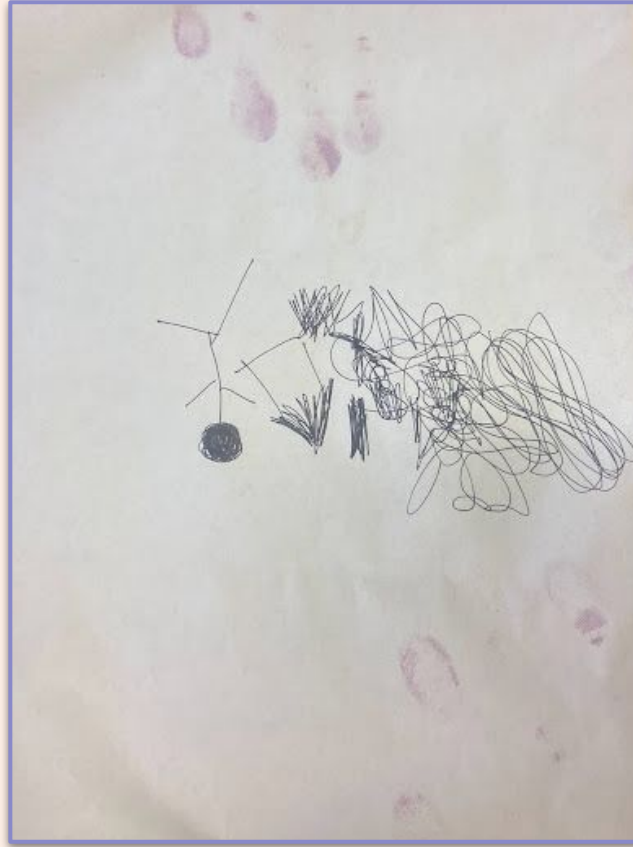Maggie Lewis
Nathan Smith
Shawn Miles

EVIDENCE #1

A drawing done by Sophia Bannow, which she was holding when she was found. This paper was tested for fingerprints from each of the suspects.

EVIDENCE #2

A second drawing done by Sophia Bannow, which she was holding when she was found. This paper was also tested for fingerprints from each of the suspects.

TYPES OF FINGERPRINTS

Plain Arch

Tented Arch

Plain Whorl

Accidental Whorl

Double Loop Whorl

Central Pocket Loop Whorl

Ulnar Loop

Radial Loop

NINHYDRIN DEVELOPING

1

Spray your evidence by using Ninhydrin solution. Put the solution into a spray bottle, and spray the entire paper.

2

Heat with a blow dryer for about one minute.

3

Let sit, wait for prints to appear!

EVIDENCE #1: Results

Bottom Hand:
-Right hand
Index: Tented Arch
Middle: Ulnar Loop
Ring: Whorl
Pinky: Radial Loop
-Most resembles: Maggie Lewis and Sophia Bannow

Top Hand:
-Left hand
Thumb: Whorl
Index: Whorl
Middle: Radial Loop
Ring: Arch
Pinky: Radial Loop
- Most resembles: Maggie Lewis and Sophia Bannow

EVIDENCE #2: Results

Bottom Hand:
-Right hand
Index: Tented Arch
Middle: Ulnar Loop
Ring: unclear
Pinky: Radial Loop
-Most resembles: Maggie Lewis and Sophia Bannow

Top Hand:
-Left hand
Thumb: unclear
Index: unclear
Middle: unclear
Ring: unclear
Pinky: Radial Loop
- Most resembles: Maggie Lewis and Sophia Bannow

Fingerprinting Results

Based on the evidence, the results show that Maggie Lewis and Sophia Bannow both demonstrate similar print patterns to the fingerprints shown in Evidence #1 and Evidence #2, however the minutiae for each is unclear. However, we can say with some confidence that this links Maggie Lewis to the crime.
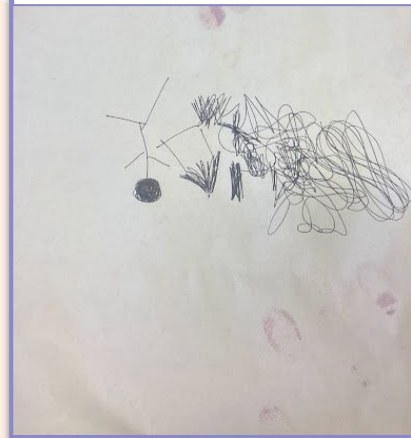
Evidence #1

INK CHROMATOGRAPHY: The ink from Evidence #1 and #2 was compared to notes found connected to each suspect.

Evidence #2

Maggie Lewis

Shawn Miles

Nathan Smith

Maggie Lewis
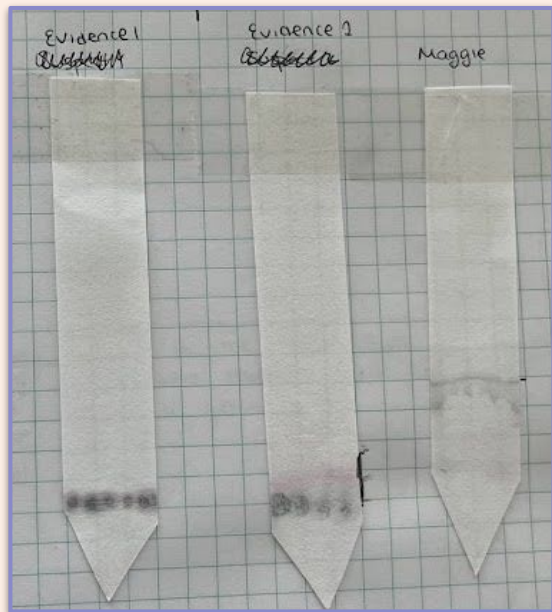
Shawn Miles

Nathan Smith

Ink Chromatography
Suspect 1: Maggie Lewis

When analyzed in water, ammonia, vinegar, and isopropyl alcohol, ammonia had the best separation.

Grocery List!
eggs
butter
Kid's cereal
milk

Analyzed ink in comparison to Evi. #1 #2 ink in ammonia.

	Maggie Rf	Evi. #1 Rf	Evi. #2 Rf
Pink	.2	N/A	.55
Blue	.4	N/A	.85

How to calculate Rf:
Distance ink travels/Distance solvent travels
Ex. (Maggie Pink Rf)
.5 cm(Distance of ink)
2.5 cm (Distance of solvent   = .2

Ink Chromatography
Suspect 2: Shawn Miles

When analyzed in water, ammonia, vinegar, and isopropyl alcohol, vinegar had the best separation.
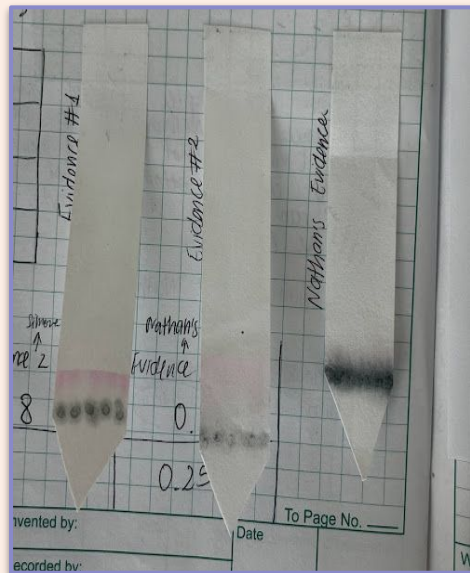
Ink Chromatography
Suspect 3: Nathan Smith

When analyzed in water, ammonia, vinegar, and isopropyl alcohol, isopropyl alcohol had the best separation.
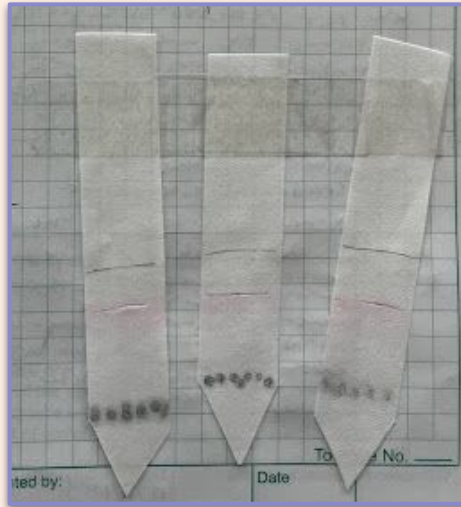
Analyzed Ink in comparison to Evidence #1 & 2 ink in isopropyl alcohol.	Nathan Rf	Evi. #1 Rf	Evi. #2 Rf
Pink	.5	1	.8
Green	.25	N/A	N/A

Ink Chromatography Results

Based on the evidence, the results show that Shawn Miles demonstrates a similar Rf and extracted ink color (pink) to Evidence #1 and #2, linking him as the suspect connected to this part of the crime.

Identification of Heavy Metals

Heavy Metal Test

The Heavy Metal Test is a presumptive test. This test will determine if lead or mercury is present in the unknown fluid found in the water bottle

Detection of Heavy Metals Using Chromatography

This is another presumptive test. This test will determine if the lead metabolite, alanine is present in the victims urine.

Infrared Spectroscopic Analysis Of Heavy Metal Metabolites

The Infrared Spectroscopic Analysis Of Heavy Metal Metabolites test is a confirmatory test. The test confirms the presence of lead or mercury metabolites in the victims urine.
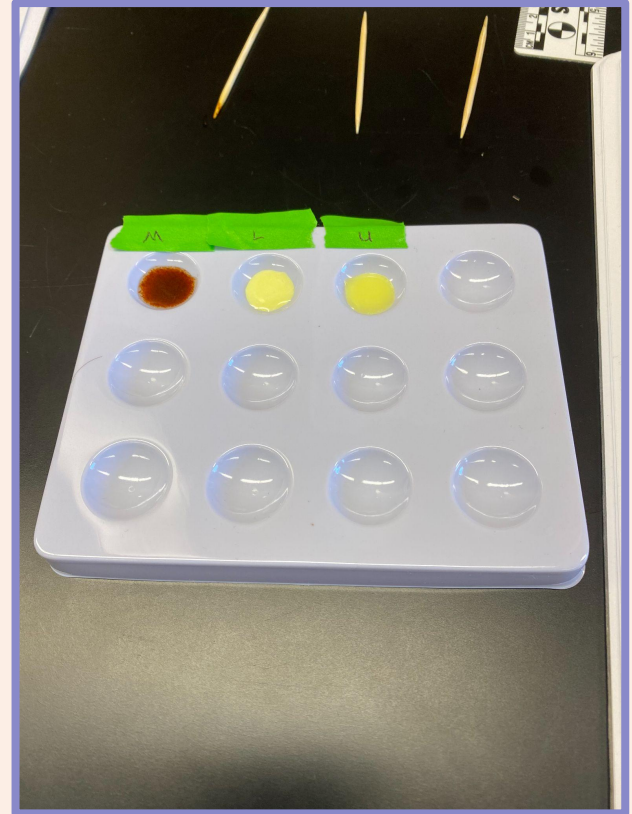
Heavy Metal Test

We used this test to determine what heavy metals could be in the water.

Steps:
1. Label the wells with M, L, and U
2. Then add 4-5 drops of each substance into their labeled wells
3. Then add 4-5 drops of potassium dichromate to each well and mix each well

Conclusion: The lead and the unknown fluid from the water bottle both turned yellow meaning, the water contains lead.

Heavy Metal Chromatography

We used this test to determine if the lead metabolite alanine is present in the victims urine.

Steps:
1. Make a line a few centimeters away from the bottom of the paper
2. Add three points on the line and label them A, G, and U
3. Add a drop of Alanine on A, a drop of Glycine on G, and a drop of the victims urine on U
4. Then leave the paper standing up in the solution
5. Spray the paper with ninhydrin
6. Then blow dry and measure the placement of the colorful blobs
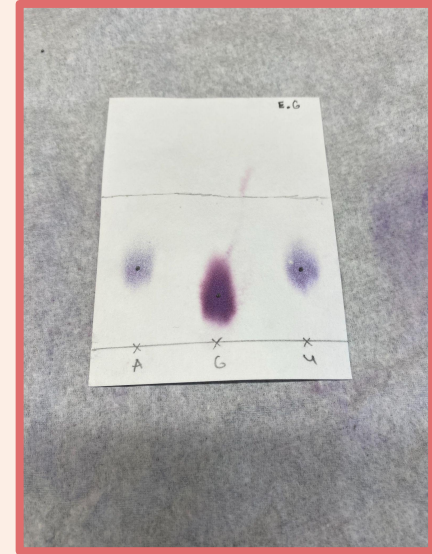
Conclusion: The victims urine and the alanine are at the same height and they are the same color so the victim most likely was poisoned with lead or something with lead in it.

Fiber Analysis

Burn Analysis

This is presumptive test. This test will determine if the fibers from the suspects and the victim are natural or synthetic fibers.
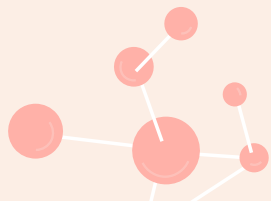
Differential staining analysis of known & unknown fibers

This is another presumptive test. This test will determine the chemical composition of the fibers from the victim and suspects.

FTIR Analysis

This is a confirmatory test. This test will determine the chemical composition of the fibers from the victim and suspects.

Burn Analysis

In this test we burned fiber to determine the difference between natural and synthetic fibers. It also helped to determine what kind of fibers the evidence fibers were.

Steps:
1. Fill a beaker with water to extinguish any fires
2. Light the bunsen burner
3. Pick up a fiber with metal tweezers
4. Hold the fiber over the flame and write your observations

conclusion: The loose evidence fiber on the victim and the fibers from shawn's blanket are both nylon.

Differential staining analysis of known & unknown fibers

In this test we dyed pieces of fabric to determine the chemical composition of the fibers from the victim and suspects.

Steps:
1.
2. Prior to your arrival in the lab have a heated beaker with the dye/stain
3. Then using forceps grab a multifiber test fabric and an evidence fiber
4. Dip them into the stain and hold it there for 3 minutes
5. Take the fibers and dip them into a beaker of water
6. Run the fibers under running water
7. Then put the fibers on a paper towel and let them dry
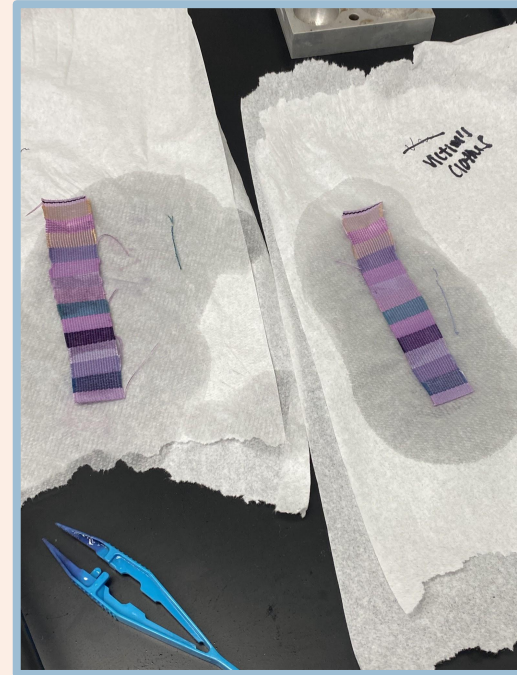
FTIR Analysis

In this test we determined the chemical composition of the fibers from the victim and suspects.

Steps:
1. Remove black cover from IR surface
2. Clean the surface
3. Open the opus software on the computer and let it go through its initialization
4. Once it's done initializing click measurement
5. Click start background measurement and wait for the loading bar to finish loading
6. Put the fiber on the IR sample surface and pull the lever towards you to lock the fiber in place
7. Click start sample measurement and wait for the loading bar
8. Then click AB to TR conversion

Conclusion: We concluded that the loose evidence fibers on the victim and the fibers in Shawn's blanket are nylon.
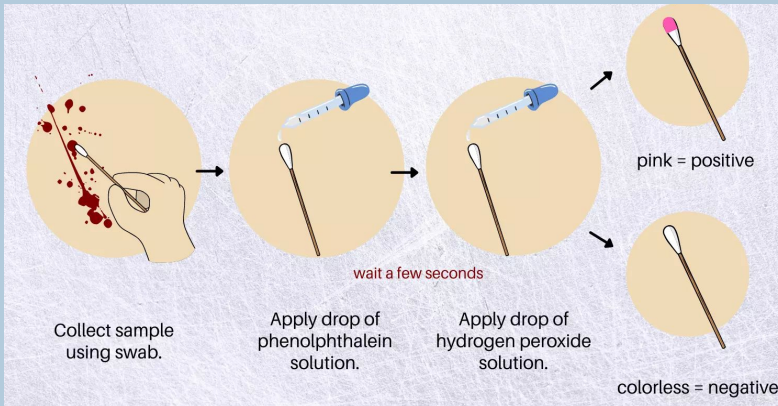
Presumptive Test for Blood

Kastle Meyer Test - Blood Typing

Mixture of phenolphthalein and hydrogen peroxide is tested on the unknown liquid or dry stain.

Positive Result: The blood's hemoglobin will cause the formation of a deep pink color.

ABO BLOOD GROUPING SYSTEM

According to the ABO blood typing system, there are four different kinds of blood types:

A: A antigens on the surface of your RCBs and B antibodies in your blood plasma.

B: B antigens on the surface of your RCBs and A antibodies in your blood plasma.

AB: A and B antigens on the surface of your RCBs and no A or B antibodies in your blood plasma.

**O (null):** Neither A or B antigens on the surface of your RCBs, both A and B antibodies in your blood plasma.

The Rh (Rhesus) antigen: If it is present, the blood is Rh positive, if not it's Rh negative.

Example: If some of the people in group A have it will therefore be classed as A+, or A positive. The ones that don't, are A-, or A negative.

Universal Donors: Group O
Universal Receivers: Group AB
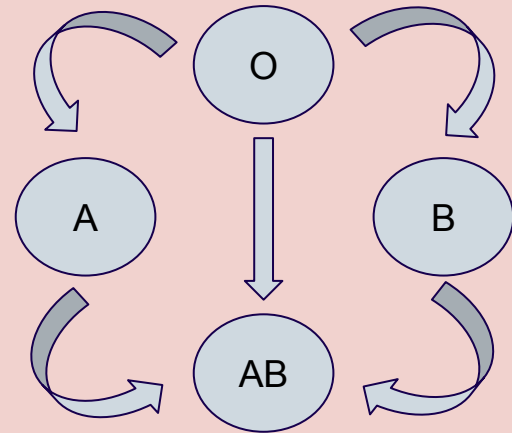
Blood typing of suspects, victim and victim nail blood
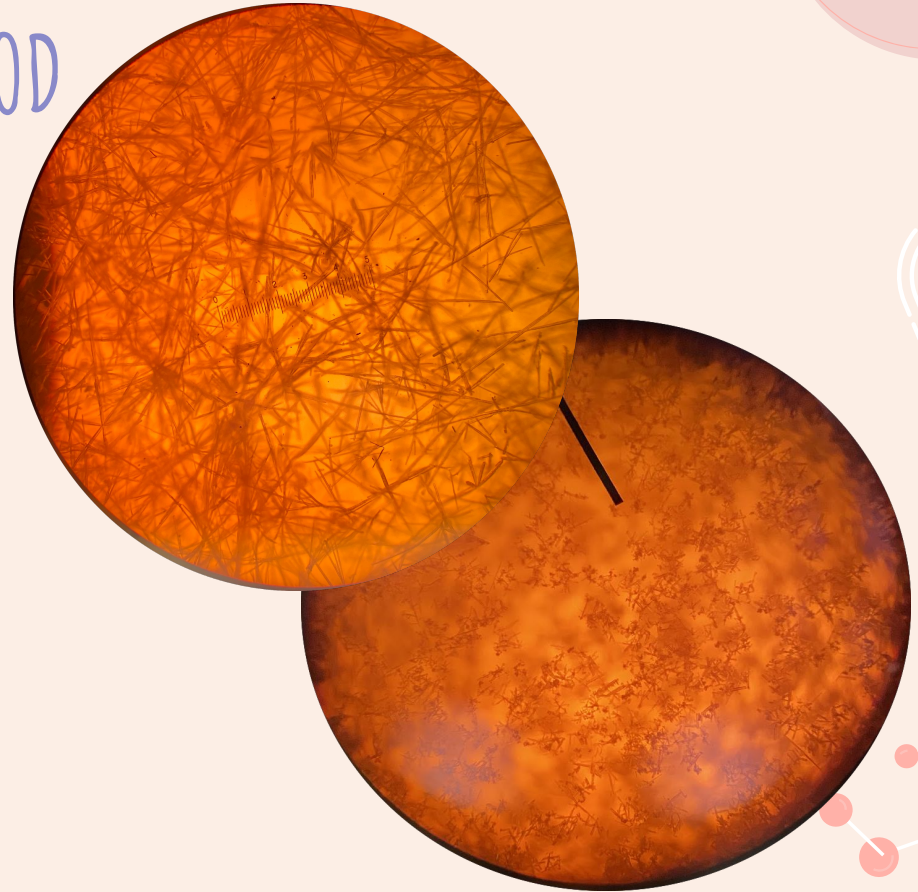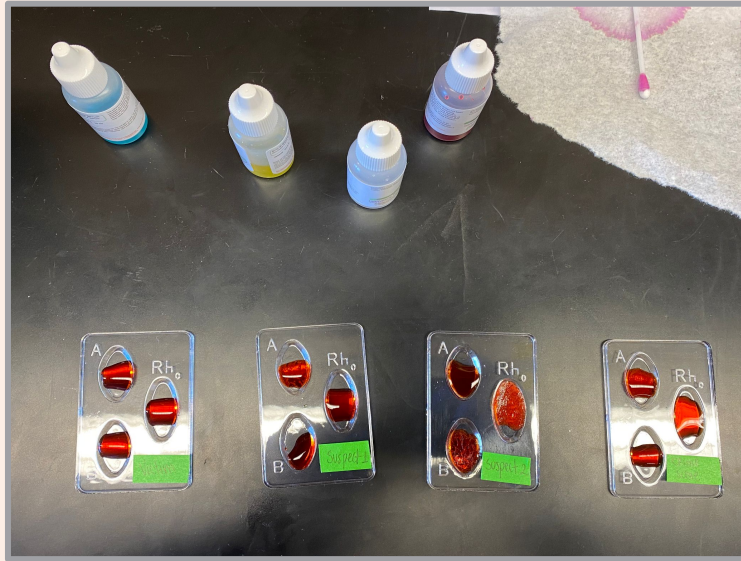
DATA

	Anti-A Reaction (- or +)	Anti-B Reaction (- or +)	Anti-Rh Reaction (- or +)	Blood Type
Victim (Sophia)	Negative	Negative	Negative	O-
Suspect 1 (Maggie)	Negative	Positive	Negative	A-
Suspect 2 (Shawn)	Positive	Negative	Positive	B+
Blood under Sophia's nails	Negative	Positive	Negative	A-

RESULT

Maggie's blood matches with the blood under Sophia's nails, they have the same blood type (A–)

CONCLUSION

- The applied techniques allowed each analysis to give it with determination. In order to find Sophia's kidnapper, several procedures were needed, in which we used evidence obtained from the crime scene.

- We applied processes such as fingerprinting, ink chromatography, toxicology, fiber analysis and blood typing.

- There are 2 suspects that coincide the most, Shawn Miles and Maggie Lewis.

- Forensics sciences, can lead us to a result that reveals how the events occurred, that can assist in the investigation and prosecution of perpetrators of crime or absolve an innocent person from suspicion.

THANK YOU!

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