

## Forensics

### NATURE Summer Camp 2016

**Project Description:** Campers will use the various forensic techniques they learned about during the presentation and their research, in order to solve a fictitious crime.

**Project Objectives:**

1. Explore how forensic science is used in criminal investigations
2. Apply the principles of forensic science to a hypothetical crime
3. Use the scientific process to solve a fictional crime

**North Dakota State Standards:**

ND Science Standard 2

9-10.2.1.

9-10.2.2

9-10.2.3.

9-10.2.4.

9-10.2.7.

9-10.2.8.

11-12.2.3.

11-12.2.4.

11-12.2.5.

11-12.2.6.

11-12.2.8

**Session Organization:**

9:00 to 9:30 Cultural Aspects

9:30 to 10:00 PowerPoint/Intro to Forensic

10:00 to 11:00 Activity 1 Set up cast of footprints/stride length measurement

11:00 to 12:00 Activity 2 Computer Research/Game

12:00 to 12:45 Lunch

12:45 to 2:30 Finish Activity 1 Explore evidence

2:30 to 3:00 Present evidence and conclusions

**Introduction:** THERE HAS BEEN A CRIME! The camp's turtle and longtime pet/mascot named Harold A. Pitz, has been kidnapped. It is your job as a crime scene investigator, to wade through the evidence and come up with the culprit. You will have several suspects or persons of interest. It is your mission to figure out who did it, bring them to justice and save Harold. The culprit left quite a bit of evidence behind. You must go through the evidence, decide which evidence will help in court and try to match the evidence to the perpetrator. The District Attorney has informed you that only evidence that points to a specific suspect will be used in court. It **MUST** be unique to the perpetrator. Evidence that points to two or more suspects is too vague. Read through the various techniques and decide which ones will aid you in doing this. The D.A. needs more than a couple pieces of evidence to put the criminal away! Try to look at as much evidence as possible and eliminate the evidence that will not help you. Good Luck! Harold is counting on you.

## **Activity 1: The investigation**

### Footprint Castings:

1. Take pictures of the scene and the footprint impressions for future reference. Document everything. It may aid in your investigation.
2. Slowly pour casting mixture over the footprint impressions, that were discovered this morning outside of the crime scene. Make sure the prints are fully submerged in the mixture. Be careful you do not damage the prints in this process.
3. Using a popsicle stick or spatula, smooth the surface of the mixture to ensure you do not have any trapped air bubbles. Make sure you mark your print to ensure that you know which print belongs to your group.
4. Make a sketch or a pencil rubbing of each of the suspects shoes. If you are creating a sketch, make sure and be as detailed as possible. Make sure to note which shoe belongs to which suspect.
5. Take pictures of the shoes as well as the soles. They may aid in your investigation.
6. Take measurements of all of the suspects shoes. Width at various points (toe, arch and heel) and length. Mark these on the sketch or rubbing. Make sure to note any abnormalities noticeable features such as wear patterns, brands names or damage.
7. Time to let the casting set. Go play the game in activity 2.
8. After the casting has dried. Carefully touch the top of the plaster impression to make sure it is solid.
9. Carefully lift the impression by placing popsicle sticks underneath the casting and gently lifting upward. You should be able to do so without damaging the casting.
10. Sand and soil can be washed off by gently pouring water over the casting. Use a soft brush to remove dirt and sand found in the gaps.
11. Study the cast. Make notes of size, width and length.
12. Compare to the archived foot wear data you have collected.

### Stride Length:

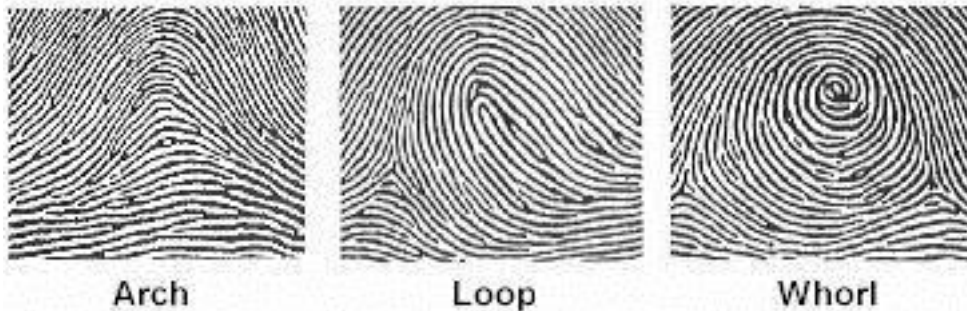
1. If you think stride length might be good evidence, make sure and measure the stride length before you take your casting.
2. Measure each stride by measuring from the heel of the footprint to the heel of the next footprint. Take as many of these stride measurements as you can and average the distance. In order to get the average, add all the stride lengths and divide by the number of stride you measured.
3. Once you have measured the stride length, you can go ahead and make the casting if you choose to do so.
4. In order to measure the suspects stride length, you will need a hallway or an area with enough room to take 10 steps.
5. You need to have the suspects stand with his/her feet together. Mark the spot where they are starting from, by placing a piece of tape at their heels.
6. Have them take 10 normal steps. They must stop after the 10<sup>th</sup> step and put their heels together.
7. Mark the ending point by placing a piece of tape at their heels.
8. Measure the distance from tape to tape and take the average. Divide the distance by 10.
9. Compare to the measurements that were taken from the footprints.

### Ink Chromatography:

1. Gather the markers found on the suspects. Make note of which marker was found on which suspect.
2. Cut several coffee filters into  $\frac{1}{2}$  inch wide strips. Make sure they are close in length.
3. Set up Chromatography apparatus. Pour Isopropyl alcohol into container about  $\frac{1}{2}$  inch deep.
4. Label the top of each strip with the type of marker found on each suspect, the suspect name or ID.
5. Place a small dot from each marker on each strip. Make sure the marker matches the label on the strip. Do not place both marks on the same strip. One marker for each strip. Place the dot  $\frac{1}{4}$  to  $\frac{1}{2}$  inch up from the bottom of the strip.
6. Cut a  $\frac{1}{2}$  inch wide strip from the ransom note. Make sure you cut out a strip that has ink from the ransom note. The ink should be  $\frac{1}{4}$  to  $\frac{1}{2}$  an inch from the bottom of the strip. Locate the ink from the note in the same location as the dots you placed on the coffee filter strips.
7. Dangle the bottoms of each strip in the isopropyl alcohol found in your Chromatography apparatus. You can use a skewer or a paper clip to hold strips above the alcohol. Do not submerge the ink in the alcohol. The ink should be just above the alcohol with the bottoms of the strips submerged.
8. Let sit and observe.

### Finger prints:

1. You will collect finger prints from the crime scene as well as from all of the suspects.
2. Find the fingerprints at the scene. Place a piece of tape over the prints and slowly remove the tape. Most of the print should come with the tape.
3. You need to collect finger prints from the suspects.
4. Draw a dark pencil smudge on a piece of scratch paper.
5. Rub fingers on pencil smudge until they are covered.
6. Put a small piece of clear tape on the pad of the finger. Gently press the tape. Carefully remove the tape and place it on the edge of a piece of paper or the clear side of a note card.
7. Repeat number 3 with the remaining fingers. Make sure you make a note of which suspect the prints were removed from. Also you should label which finger each print was removed from.
8. The FBI categorizes fingerprints by these three different patterns. Loops, arcs and whorls



9. Make sure you make note of each of these distinguishing features.
10. Make note of the distinguishing features left by the offender.
11. Compare the finger prints from the suspects to the fingerprint left by the criminal.

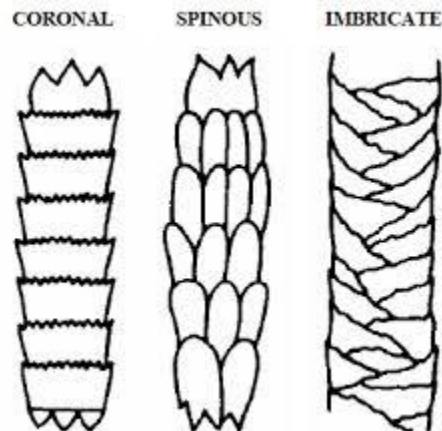
### Hair and Fiber examination:

1. Obtain the suspects hair and fiber samples that have been collected from the evidence bag.
2. Use the lint roller and package tape to obtain fiber samples from the clothing of the suspects. Apply roller or tape to the clothing and remove. Make sure you make note of where and who

the sample was obtained from. Fold the tape over on itself so it is no longer sticky. You will be able to look at your sample under the microscope. If you are using a lint roller you will have to scrape the sample off the roller and place it on a slide.

3. Obtain a clean microscope slide and place a drop of mountant or water on it.
4. Place several strands of hair or fibers on the drop of mountant or water.
5. Use forceps and slowly lower a coverslip onto the drop of mountant or water.
6. Examine the slide under the low- and high-power objectives of a microscope. Examine several different sized hairs while noting any internal features such as granules or air spaces. Draw the hair showing the observed features.
7. Scientists study a cast of the hair shaft for determining scale pattern. The arrangement and shape of hair scales can vary greatly and are often very distinctive. Scientists usually classify scales into 1 of 3 categories:

1. Coronal—Completely encircling the hair shaft
2. Spinous—Long, narrow, and not encircling the hair shaft
3. Imbricate—Short, wide, and not encircling the hair shaft



Imbricate is more specific to humans so looks for patterns or gaps in the scales

Your own evidence:

If you notice something that you think might separate the offender from the suspects, feel free to explore these ideas. Remember you are collecting and analyzing evidence that will be specific to the offender. Evidence that is too vague or hard to separate from the other suspects will do you no good and the D.A. will not be able to use it in a court of law.

Presentation:

You must present your evidence to the other groups and instructors. Explain which suspect you think was guilty of the crime. Go through each piece of evidence you chose to explore and explain why you chose to use it, what you found, and how it is unique to one suspect and not the others. Explain why you chose not to use the other evidence you were presented with.

## **Activity 2: The Game**

Activity 2 is to be done after the casting have been poured and are drying. The casting will take around 1 hour to 1 hour and a half to dry.

1. Go to <http://forensics.rice.edu/> and play around with the game CSI The Experience

Wrap up and Discussion questions:

1. What other physical evidence would have been helpful in determining who committed the crime in the classroom? What kinds of analysis could you do on the other pieces of evidence? (Measure a footprint to find out shoe size; analyze the tread to determine the type of shoe; compare handwriting samples; analyze other fibers.)
2. What if you were called in to collect evidence from the scene of an art theft? How would you go about collecting evidence? What would you do with your findings? What analyses would you perform on each piece of evidence? What precautions would you need to take to make sure your evidence was authentic
3. How important is technology to detectives? Can detectives do an effective job using the same tools you used, or must they use more sophisticated tools? Give reasons to support your ideas.