*Please do not write on this paper. You need to write the procedure out on your note book.*

**Simplified Fingerprint Analysis**

Introduction: Why use Fingerprints in a Criminal Investigation?



According to most professional criminal investigators, fingerprints obey three fundamental principles. These principles are:

1 . A fingerprint is an individual characteristic. It is yet to be found that prints taken from different individuals possess identical ridge characteristics.

2 . A fingerprint will remain unchanged during an individual’s lifetime.

3 . Fingerprints have general characteristics ridge patterns that permit them to be systematically classified.

This individuality of any fingerprint is based not upon the general shape or pattern that it forms, but instead upon its ridge structure and specific characteristics (also known as minutiae). The recognition of these ridges, their relative number, and the approximate location of them, on the observed print, are the special characteristic that make the fingerprint a specific identifying characteristic of each individual. There are at least 150 individual ride characteristics on the average fingerprint. If between 10 and 16 specific points of reference for any two corresponding fingerprints identically compare, a match is assumed.

In a judicial proceeding, a point-by-point comparison must be graphically demonstrated for at least 12 different, but corresponding, points in order to prove the identity of a specific person. An example of typical ridge characteristic is shown in the drawing below.

**Identification of Print Characteristic**

There are three specific classes for all fingerprints based upon their general visual pattern. These are: loops, whorls, and arches. Approximately 60% of the population has loops, 35%have whorls, and 5% have arches. The three major groups are also subcategorized based upon smaller differences existing between the patterns within the specific group. These categories are as follows:

**I . Arch II . Loop III . Whorl**

a ) Plain arch a ) Radial Loop a) Plain Whorl

b ) Tented arch b ) Unar Loop b ) Central pocket whorl

c ) Double loop

d )Accidental whorl

There are actually three kinds of *CRIME-SCENE* prints. These are:

1. *VISIBLE PRINTS* which are prints made by fingers touching a surface after the ridges have been in contact with a colored material such as blood, paint, grease, or ink.
2. *PLASTIC PRINTS*  which are ridge impressions left on a soft material such as putty, wax, soap, or dust.
3. True *LATENT PRINTS* which are invisible prints impressions caused by the perspiration on the ridges of one’s skin coming in contact with a surface and making an invisible impression on it. Perspiration contains water, salt, amino acids, or oils and easily allows impressions to be made.

The most common techniques used to find latent or hidden fingerprints include:

1. Dusting with aluminum Powder for hard or dark colored surface as well as mirrors and metal surfaces.
2. Dusting with fluorescent Powder for dark surfaces.
3. Dusting with Carbon Powder on white or light colored surfaces.
4. Dusting with magnetic powder.
5. Use of Ninhydrin
6. Use of Iodine fuming techniques.
7. Use of cyanoacrylate (super-glue) fuming
8. Use of silver nitrate.

**Procedure**

**Part I: Dusting for Latent Fingerprint**

1. Obtain a clean microscope slide or you can clean one up yourself. Write your name on the side with a permanent marker. Make a latent fingerprint.

***Note:*** *Each station is allowed to take only one type of powder: Aluminum, charcoal, fluorescent, or magnetic along with the proper fiber dusters.*

2. Place some powder on a sheet of paper labeled with the powder type used.

3. Sprinkle the dust onto the slide by holding the brush about 1 cm above it and lightly tapping the brush a few times.

4. They then distribute the powder evenly over the surface by tilting and tapping the edge of the slide with your finger.

5. After all of the print is covered; the excess powder should be removed by gently tapping the object on the side while holding it over the beaker containing the powder. If some excess powder still remains it can be removed by gently brushing or blowing it off. If you do blow the dust off, be careful **not to inhale the dust or blow it toward anyone.** If you elect to use the brush to remove excess powder, be careful not to destroy the print with too hard a brush stroke. Save the remaining powder by replacing it into a beaker.

6. To lift the print from the slide to the notebook, they will unroll about 5” to 6” of tape and place the end to the right of the thumbprint on the slide and allow the tape to cover the whole print. You then slide a thumb over the tape and smooth it down over the print to force out all air bubbles.

7. The print can be removed by pulling up on the roll-end of the tape and then placing it on the notebook, in the same manner as the tape was placed over the fingerprint. You must make sure the tape is secure. You will cut the tape from the roll.

You will be using the same method for all different dusts except for Aluminum and Fluorescent Powders. For aluminum powder, once you lift the print, place it on a black index card. Then tape the black index card with print in your notebook. For fluorescent powder, check you print using a UV light. If the prints are not clear, please redo.

Note: You will be using the same microscope slide through out the dusting procedure. Clean the slide after each dusting by using a paper and be sure to trash in the trash bin. None of the powders go down the drain.

**Part 2: Chemical Analysis for Latent Fingerprint**

**Safety: For all chemical analysis you need to wear your goggles at all times.**

**A. Using Ninhydrin to Develop a Print on Paper**

This exercise introduces some organic chemistry or biochemistry, such as the structure of an amino acid. Ninhydrin reacts with amino acids in the perspiration on the print to form a pink or purple compound.

**Caution: Do the following in a fume hood or in a well-ventilated area. The acetone used in preparing the ninhydrin solution is volatile and flammable. Keep this solution away from open flames.** When working with the ninhydrin solution as it will react with amino acids on their skin and turn them purple! **It does not wash off well so be careful.**

1. Prepare ninhydrin solution by adding the solid ninydrin vial to the bottle of acetone. Prepare the day of the experiment. (This is done by the instructor)
2. Cut a filter paper in half (be sure to touch only the edge of the filter paper).
3. Place right thumb prints on the paper the two halves. You will use half for ninhydrin and the other for iodine lab. Write your name and the solution used.
4. Then you dip the tip of a small brush into the ninhydrin solution and carefully dab this liquid over the fingerprint is. Not using too much pressure since that will destroy the print.
5. Allow the paper to dry. It may take 2-3 hours to develop.
6. Next day, pick up your print from the fume hood and attach to your notebook.

**B. Using Lugol’s Iodine to Develop a Print on Paper**

This exercise illustrates chemical concept of sublimation.

The dusting process used in the first section cannot be used to develop a print on paper because the water from the perspiration spreads out and the print appears smeared. Exposing the print to lugol’s iodine will develop the print. The only material on the print absorbs the iodine vapor and produces a violet to purple-brown fingerprint.

**Procedure**

1. Place 10 drops of lugol’s iodine in each jar. This will be the developing chamber.
2. You then cut a piece of tape about 1” long and place half of it on the top of the filter paper you prepared in section A (right thumb print). Open the jar containing the lugol’s iodine and quickly tape the paper to the lid so that the paper hangs down in the jar. Replace the lid and allow the print to come in contact with the iodine vapor for about 3 to 5 minutes or until the print is visible.
3. Once they can see the developed print, use tweezers to remove the paper from jar. Be sure to quickly replace the lid on the jar.
4. The developed print will gradually disappear since the iodine will continue to sublimate. To “save” the print, spray the print with starch solution. This will “fix” the print for a few weeks. Place the print in your notebook.

**C. Using Cyanoacrylate to Visualize Prints**

**Caution:** Super glue will adhere to your skin and possibly ruin the object being examined.

**1.** Prepare a latent fingerprint on an acetate or plastic spoon.

2. Shape a piece of aluminum foil into a shallow cup and center it in the bottom of the mason jar.

3. Add 10 drops of super glue to the foil cup dropping it into the middle of the bottom.

4. Tape the acetate to the jar. It should not touch the bottom of the jar. Cover the top of the jar tightly with foil and tape it tightly.

5. After 2-3 hours, a permanent print should appear. Dust with charcoal and lift. Place the print in your notebook.

**D. Using silver nitrate to visualize prints**

**Caution:** Silver nitrate can cause blindness. Please keep your goggles on. Silver nitrate like ninhydrin can stain your hand and will take some time to come off. So be sure to not get it on your hands. Finally, Silver nitrate does not go down the drain. When rinsing excess silver nitrate, be sure to rinse it off in an assigned container.

1. Place a right thumb print on a small filter paper.

2. Place two drops of silver nitrate solution on the filter paper. Place the paper under UV light.

3. Once the print develops, wash off excess silver nitrate with water. Be sure to do this using a designated container.

4. Dry the print overnight and place it in your notebook.