Read the Found Prints
A Lab on Fingerprint Analysis

The Mystery of Lyle and Louise
FINGERPRINTS are impressions of the friction ridges on the finger that are transferred onto a surface by some substance or by oil and perspiration that naturally exists on the body. Friction ridges exist on finger pads, and the patterns are determined by the dermal papillae (located between the epidermis and dermis layer of the skin). Because these patterns are unique to each individual, friction ridge patterns can be used as a means of personal identification.

Fingerprinting has been used in forensic science for over one hundred years, however, there are known documents which show that several different countries, such as China, have used fingerprinting for signing legal documents as far back as three thousand years. In 1880, Henry Fauld was the first to record how the skin ridge pattern could be used as an infallible proof of personal identification. His hypothesis was rejected by the British Government, and, in 1883, the country adopted the Bertillon system instead. This identification system used anthropometry (height, reach, width of head, and length of the left foot) as a means of identification.

Sir Francis Galton, a British scientist and statistician, published three texts and a Royal Institution paper that described the anatomy of the finger and fingerprint recording procedures. Galton’s paper also provided convincing arguments, based upon statistical population analysis, that no two prints were identical and that the prints remained unchanged throughout the individual’s lifetime. The British Government later adopted a fingerprint system based on Galton’s work to supplement the Bertillon system. The United Kingdom Fingerprint Bureau was founded in Scotland Yard, a division of the London police, in 1901. In that same year, the US New York City Civil Service Commission adopted the first systematic and official use of fingerprints for personal identification.

One of the most famous cases solved by fingerprint analysis, often called the greatest art theft in the 20th century, occurred when Leonardo da Vinci’s painting, Mona Lisa, was stolen from the Louvre Museum in Paris on August 21, 1911. The suspect left a clear fingerprint on the glass casing. Police officer Alphonse Bertillon spent many months examining a compilation of prints, but no match was found. Two years later, police arrested Vicenzo Perugia in connection with the crime after determining that his thumbprint matched a print found at the crime scene. In many similar cases, fingerprints have become critical evidence for finding the suspect.

Fingerprints are unique to an individual, and, therefore, can be used as a personal identification. Over the many years of the use of fingerprints in forensic science, no two identical fingerprints have been found. According to Sir Francis Galton, the chance of two individuals having an identical print is 1 in 64 billion. Fingerprints are unique not because of their shape or pattern, but by the relative locations of the minutiae (characteristics of the ridges). Some examples of minutiae include: ridge endings, bifurcations, lakes, short ridges, islands, and crossovers. Fingerprints will remain unchanged during an individual’s lifetime, although scarring, such as burns or deep tissue damage, may obscure the minutiae. General ridge patterns allow for prints to be systematically classified. The three basic identifying patterns used for fingerprint analysis are loops, arches, and whorls.

Loops appear in sixty to sixty-five percent of the population and are comprised of ridgelines that enter on one side, turn around in a curve, and exit out the same side. The pattern area of the loop is surrounded by two diverging ridges. A loop consists of a core (center of the pattern) and only one delta. This mark looks like the Greek letter delta (Δ) and is a triangulation, or a dividing, of the ridges. By definition, the existence of a core and exactly one
Fingerprint Analysis

delta makes a pattern a loop. There are two types of
loops: loops that open towards the little finger are
called ulnar and others that open toward the
thumb are called radial.

Arches appear in about five percent of the popula-
tion and consist of ridgelines that enter from one
end and flow out the other side, usually forming a
wavelike pattern. Arches have neither a core nor a
delta. Any pattern without a delta should be con-
sidered to be an arch pattern. Arches are the most
simple fingerprint, but they are very uncommon,
especially on the little fingers. The arch type is ei-
ther plain or tented. Plain arches have only a gentle
rise, while tented arches have a sharp rise in the
center.

Whorls are displayed in thirty to thirty five percent
of all prints and consist of ridgelines that are gener-
ally rounded in shape and make at least one com-
plete circuit. Any fingerprint pattern that contains

The Henry Classification System

It is necessary for fingerprint analysis to have a method
of classification. There are several different classifica-
tion systems used in the world. The most popular ten-
print classification systems include the Roscher system
(used in Germany and Japan), the Juan Vucetich system
(used in Argentina), and the Henry Classification System
(used in most English-spoken countries).

The Henry Classification System uses the loops, whorls,
and arches approach. The primary classification of the
Henry system categorizes ten-print fingerprints into
one of the primary groups, with 1,024 possible groups.

As seen in the table below, each finger is numbered from
one to ten beginning from the right thumb, numbered
one, and ending with the left pinky, numbered ten. De-
dpending on the presence or absence of the whorl pat-
ttern, each finger is assigned a value.

<table>
<thead>
<tr>
<th>Assigned Number</th>
<th>R Thumb</th>
<th>R Index</th>
<th>R Middle</th>
<th>R Ring</th>
<th>R Pinky</th>
<th>L Thumb</th>
<th>L Index</th>
<th>L Middle</th>
<th>L Ring</th>
<th>L Pinky</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value (if Whorl is present)</td>
<td>16</td>
<td>16</td>
<td>8</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Example</td>
<td>0</td>
<td>16</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Henry Classification Formula</td>
<td>Sum of Odd finger value + 1 = Grouping Ratio&lt;br&gt;Sum of Even finger value + 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grouping Ratio for Example</td>
<td>0 + 0 + 0 + 2 + 0 + 1 + 1 = 3&lt;br&gt;16 + 8 + 0 + 1 + 1 + 1 = 26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fingerprint Analysis

at least two deltas will be a whorl pattern. Whorls are very common, especially on the thumb, index, and ring fingers. There are four types of whorls: central pocket loop whirls, plain whorls, double loop whorls, and accidental whorls. Plain whorls consist of one or more ridges that make a complete circuit with two deltas; if an imaginary straight line is drawn from one delta to the other, at least one circular ridge within the inner pattern of the circuit will intersect the line. Central pocket loops consist of one or more ridges that make a complete circuit with two deltas; if an imaginary straight line is drawn from one delta to the other, at least one circular ridge within the inner pattern of the circuit will intersect the line. Central pocket loop whorls consist of one or more ridges that make a complete circuit with two deltas; if an imaginary straight line is drawn from one delta to the other, none of the circular ridges within the inner pattern will intersect the line. Double loop whorls are made up of two separate loops on one fingerprint, with their own set of two deltas. Accidental whorls contain two or more different patterns, but are not arches and are not covered by other categories.

There are four different types of fingerprints: known prints, patent prints, plastic prints, and latent prints. Known prints are deliberately collected from the subject by an ink impression or scanning. There are two types of ink impressions, rolled and flat (also known as plain). Most often the rolled type of impression is used to ensure that all details of the ridges are obtained. A rolled impression of the fingers is taken by coating the finger pad with ink and rolling the finger from one side of the nail cuticle to the other. The thumbs are rolled towards the center of the body (e.g. right thumb is rolled from right to left) and the fingers are rolled away from the center of the body (e.g. the fingers on the right hand are rolled from left to right). Currently, most known fingerprints that are collected by the Government are scanned into the Automated Fingerprint Identification System (AFIS).

Patent (or visible) prints are made by fingers coated with a substance (e.g. blood, ink, dirt). Plastic prints are three-dimensional impressions made in pliable surfaces (e.g. wet paint, wax, soap). Patent and plastic prints can be easily located at a crime scene, as they are easily visible with an un-aided eye. On the other hand, latent prints are invisible to the naked eye and require enhancement that will make the print visible. Latent prints are impressions made by the transfer of natural oil or perspiration that are present on the finger. They are more commonly found at crime scenes than any other prints.

Development of latent prints can be achieved through chemical, powder, lighting, and photographic methods. The method of treatment depends on the surface where the print is located. Prints on non-absorbent surfaces (e.g. mirror, tile, and painted wood) can be developed by treatment with powders or cyanoacrylate (Super Glue). The powder type used varies based upon the background of the print. Some examples are black powder, magnetic-sensitive powder, and fluorescent powder. Super Glue fuming has become a popular test for non-absorbent surfaces. In this test the cyanoacrylate ester in the super glue interacts with a latent print to give it a white appearance.
Minutiae: Characteristics of the ridges, which include
ridge endings, bifurcations, lakes, short ridges, and cross-
overs.

Loops: Ridgelines that enter on one side, turn around in a
curve, and exit out the same side.

Arches: Ridgelines that enter from one end and flow out
the other side, usually forming a wavelike pattern.

Whorls: Ridgelines that are generally rounded in shape,
where the ridges make at least one complete circuit.

Known Prints: Fingerprints that are deliberately collect-
ed from the subject by an ink impression or scanning.

Patent prints: Fingerprints that are made by fingers coat-
ed with a substance, such as blood, ink, dirt, etc.

Plastic prints: Fingerprints that are three-dimensional
impressions made in pliable surfaces, such as wet paint,
wax, soap, etc.

Latent prints: Fingerprints that are made by the trans-
ferral of natural oils or perspiration present on the finger.
These prints are more commonly found at crime scenes
than any other prints.

AFIS (Automated Fingerprint Identification System): A
computer system that automatically searches electroni-
cally stored fingerprints and generates a hit list once a
fingerprint is scanned.

Quality Prints Diagram

NOT ROLLED FULLY

TOO LIGHT

INK UNEVENLY DISTRIBUTED

TOO DARK

ACCEPTABLE
Nine days ago, during the night of a sudden summer thunderstorm, the Mondelo family car went over the side of Backbone Mountain and caught fire on impact. Three bodies were found in the wreckage: an adult woman, a teenage male, and a female child. All were burned beyond recognition. The three victims were identified as Louise Mondelo and her children, Wally and Jan, by personal effects that survived the fire.

Pictures of the scene were recorded but, due to the rainstorm, the crash was initially believed to be simply a tragic accident and was not treated as a crime scene. When Lyle Mondelo could not be reached and was found to be missing, he became a possible suspect, and the wreckage was thoroughly processed. The scene was substantially disturbed and some evidence was undoubtedly lost however, upon retracing the path of the vehicle, investigators found several pieces of broken glass lying in the roadway. Becoming increasingly more suspicious of foul-play, the broken glass fragments were packaged and retained. In addition, investigators cut and removed a section of charred carpet from the vehicle for further laboratory analysis. The bodies, as part of an ongoing criminal investigation, were kept in the county morgue.

The small town of Highland Park was shocked, since nothing this terrible had ever happened in the area. Tips from neighbors and friends poured into the police department, but none of the tips were eyewitness accounts or provided specific information regarding the car accident. Lyle was the likely suspect but was nowhere to be found. An all-points bulletin was issued for everyone to be on the lookout for Lyle Mondelo. He was presumed armed and dangerous and to be driving a missing, blue, 1993 Ford Ranger with Tumbling Water Land Development Co. logos. Four days ago, Lyle Mondelo’s credit card was used to purchase gasoline and food at a gas station in Texas.
The Investigation

When contacted, business associate John Wayne Gretzky told investigators that Lyle had been slipping into a deep depression because of trouble at their jointly owned business, Tumbling Water Land Development Company. Gretzky also hinted that there had been problems in the Mondelo family. At this time, investigators noticed that John had a large bite mark on his upper arm. When asked about the wound, Gretzky claimed to have been bit during a bar fight the night before and allowed the bite to be photographed. He was not held or charged with any crime.

Background Investigation

With no additional leads, police launched a full investigation into the Mondelos. Louise Wilson and Lyle Mondelo had met at college while receiving Business Degrees in Management. They married in college and moved to Highland Park, Louise’s hometown, after graduation. The town was still ailing at the time, suffering from the shut down of the mines a little over a decade ago. Although at first Lyle thought their business prospects in the small town were poor, he soon discovered that money could be made developing land for the private lodges and ski resorts that employed most of the residents.

After returning to Highland Park, Louise ran into her old high school sweet heart, John Wayne Gretzky. While talking to him, Louise learned that he was also a developer. Glad to see an old friend, and thinking that a favorable business relationship could develop, Louise asked John to meet with her and Lyle over dinner. Lyle and John soon became friends, and rather than compete for business against each other, the three decided to join together and start Tumbling Water Land Development Company.

A year after Tumbling Water was founded, Louise conceived her first child, Wally. Friends of the Mondelos said that Lyle suspected Louise and John of having an affair at the time, and the two nearly divorced. The couple worked out their relationship with the help of a marriage counselor.

Tumbling Water became prosperous and was able to buy several hundred acres of land adjacent to Blackrock River, a prime recreational waterway. Soon thereafter, Louise had another child, Ian, and took leave from the office to work from home while she raised the two children. Friends say that Louise never really went back to Tumbling Water, even after the children were older and in school. Their friends also suggested that Lyle and Louise’s relationship was healthier with them not working together.

Tumbling Waters’ lawyer told investigators that she began preparing bankruptcy papers for the company about a year ago; the ski resort was dragging out negotiations for a property purchase, and the company’s other business deals weren’t making enough profit to keep the business afloat. Soon after being asked to begin the bankruptcy filing, though, she said an unexpected deal was made to build a number of fishing cabins on the Blackrock River land. That was enough to keep the business going, and after that, Tumbling Water began making deals at a steady rate.

A potentially related case recently touched on the Mondelos’ lives. Three weeks ago, a crystal methamphetamine lab was discovered in an abandoned camper on Tumbling Water land. Louise’s nephew, Mitch Wilson, and John Wayne’s brother, Larry Gretzky, were found in the lab and indicted for possession with intent to sell the 6 kilograms of meth found in the lab. Two days later they were both released on bond, posted by Lyle Mondelo and John Gretzky, Mitch and Larry gave no names of possible suppliers or dealers.

Two weeks before the crash, Louise Mondelo filed for divorce. Friends say she told them that she suspected Lyle of being involved with drugs, but that the friends believed she was involved with John Wayne Gretzky again. Two days later after filing for divorce, Louise requested a restraining order against Lyle, stating that Lyle had harassed her and the children. Louise also told police that she was afraid that Lyle might try to take the children away.

When attempting to contact Mitch Wilson and Lar
Fingerprint Analysis

for porous surfaces (e.g. cloth, paper, and cardboard) chemical treatments are utilized, such as iodine fuming, ninhydrin, or physical developer (silver nitrate-based reagent). Iodine fuming is the oldest method used for visualizing latent prints. Iodine crystals are heated in a chamber with the latent print and the iodine fumes that form combine with the oils in the latent print to make it visible. Iodine prints, however, are not permanent and are, thus, quickly documented and photographed. Many new chemical treatment processes are now available. Latent prints may also be developed through fluorescent techniques. Some of the techniques include the use of an argon ion laser (natural fluorescence by components of perspiration and blood), alternate light source, Reflected Ultraviolet Imaging System, and dyes and powders as discussed above. The most widely used fluorescence technique in labs and crime scenes is the alternate light source. An alternate light source is any high intensity light source, other than a laser, that filters the origin light and induces luminescence at the wavelength known to excite the latent print.

After the prints are detected and developed they must be preserved for future inspection and evidence. A photograph is taken before any attempts at preservation are made. If the object that the prints are located on is small, then the object is preserved in its entirety. Conversely, if the object is too large, the prints can be preserved by a lifting technique after the prints have been developed with a powder. The most commonly used type of lifter is a wide adhesive tape, similar to Scotch tape. After the powder has been transferred onto the tape it is placed onto a labeled card that provides a greater contrast with the powder and allows for detailed examination of the print.

Usually, when fingerprints are lifted from a crime scene they are not in a perfect condition making analysis of the print difficult. Photographed or scanned fingerprints from a scene can be inputted into computer software to create a digital image. Through the use of digital imaging, a developed print that is obscured can be further enhanced by removing the background and, thus, clarifying the details within the print. Digital imaging is utilized extensively in forensic laboratories and is especially valuable in examining latent prints.

Currently, many countries use the Automated Fingerprint Identification System (AFIS) to classify fingerprints. AFIS is a computer system that automatically searches electronically stored fingerprints and generates a hit list once a fingerprint is scanned. AFIS has become a successful tool in the capture of many unknown criminals. Through AFIS, finding a matching fingerprint for a single print found at a scene takes only hours instead of months or years.

Fingerprints are among the best and most convincing of all types of physical evidence for identifying people with locations or objects. Although fingerprint analysis can be the key to many unsolved crimes, it is not infallible. Thus, fingerprint analysis must be done conscientiously as there can be great room for error. The AFIS can assist in giving a hit list of potential suspects, but the examiner must still analyze and confirm the potential match.

Most fingerprint experts work under federal agencies, such as the Federal Bureau of Investigation, the Drug Enforcement Administration, the Secret Service, and the Bureau of Alcohol, Tobacco, Firearms, and Explosives. Depending on the specialty, they collect, examine, analyze, compare, and classify using the Henry System, as well as the Automated Fingerprint Identification System (AFIS). Fingerprint analysts also testify in courts to clarify the evidence. As the fingerprint specialist career has advanced, certain professional criterion has been developed. The Latent Print Certification Board of the International Association for Identification (IAI) has developed and administers a certification test for latent print examiners. This certificate sets a standard for the profession. This certification, in addition to a bachelor's degree, is often required by law enforcement agencies prior to employment.
ry Gretzky for questioning about the car accident, police discovered that they had both skipped town along with Larry’s girlfriend, Mary Braden. Authorities believed that their disappearance could be related to the accident, and they were described as possibly armed and dangerous in the warrant posted for their arrest.

Two days ago, an abandoned blue Ford Ranger with out-of-state plates was found on a strip of New Mexico highway. The pickup was dirty and a headlight was broken, but investigators noticed a Tumbling Water Land Development Co. sign on the back tailgate. Forced entry was apparent. Upon access to the truck, investigators discovered several pieces of trace evidence and sent it to Highland Park for analysis.

**At the Scene**

This morning the bodies of two deceased victims were discovered in a remote fishing cabin on property owned by Tumbling Water Land Development Company. The cabin, isolated from view of the main road and deeply buried in the thick woods, lies along the bank of the Blackrock River and is accessible only by a gravel road cutting into the forest. Soon after the bodies were discovered, the small cabin was surrounded by police tape and investigators combing the scene in search of evidence.

Detective Murray, the lead investigator in the case, explained, “A Girl Scout on a hiking trip found the victims about an hour and a half ago. There are two bodies inside, both in advanced stages of decomp; PMI undetermined. The female vic was identified as Louise Mondelo, the same woman identified in the car that ran off Backbone Mountain and caught fire during the storm last weekend. The bodies are in bad shape, but hopefully we’ll get a positive ID when DNA analysis comes back.”

Inside the cabin the smell of advanced human decay was overwhelming. The overturned chairs and tables led investigators to conclude that a violent struggle had taken place. The smaller body, dressed in a blouse and jeans, was found near the phone in the kitchen. The larger corpse was dressed in a man’s polo shirt and slacks lying in the corner to the left of the door, and blood covered the walls and floor around him. Investigators collected maggots from the corpses to help establish a time of death and collected DNA samples from both victims. While processing the scene, flesh was discovered scraped across the stone of the fireplace, and blood and skin were found on a piece of firewood lying near the woman’s body. Samples of both were collected for analysis. The wounds upon the head of the female victim appeared consistent with the firewood, but a definitive determination was difficult to make due to the state of decay. Outside of the cabin, a set of tire tracks were found deeply rutted in the mud and grass. As none of the investigators had driven near that area, dental stone molds were cast of the tracks and pictures were taken to preserve evidence.
During the investigation of John Gretzky, the Highland Park detectives visited the office of the Tumbling Water Land Development Company. When they walked through the office, they noticed that the safe is open and empty. Upon looking closer, the detectives found fingerprints on the door of the safe. As the only two people with authorized access to the office safe were Lyle and Louise, all suspicious prints were lifted for further examination.

When questioned, John told the investigators that the safe was always locked when the office was empty and that he did not know the code to open the safe. Fingerprint analysts have determined that all of the prints were left by the same person.
Persons of Interest

The Mondelos

Louise Ann Mondelo, the 38 year old wife of Lyle Mondelo and mother of Wally and Jan, is also one of the owners of Tumbling Water Land Development Company. Friends say that Louise was in an unhappy marriage and had recently filed for divorce.

Lyle Christopher Mondelo, the 40 year old husband of Louise Mondelo and father of Wally and Jan, is a part owner of Tumbling Water Land Development Company along with his wife.

John Wayne Gretzky

John Wayne Gretzky is 41 years old. He is a friend and business partner of the Mondelos in the Tumbling Water Land Development Company. According to rumors, John Wayne and Louise had a brief affair when Lyle and Louise first moved to Highland Park. He is known around town to be a greedy businessman, and has been suspected of shady deals in the past.

Larry Gretzky and Mitch Wilson

Larry Gretzky and Mitch Wilson were recently indicted on charges related to their apparent operation of a methamphetamine laboratory. Larry was bailed out by his brother, John Wayne, and Mitch was bailed out by his uncle, Lyle Mondelo. Larry and Mitch failed to appear in court and are currently missing. Police are interested in locating them for questioning.
1. What are the three basic categories used for fingerprint analysis?

2. Describe the pattern of one of the three basic categories.

3. What is minutiae? What are some examples of minutiae?

4. What is a known print?

5. What is the most commonly found fingerprint at a crime scene?

6. How do forensic technicians analyze an incomplete print lifted from a crime scene?

7. Name one popular classification system.

8. What is AFIS?
Classifying Fingerprints

The three major fingerprint patterns are loop, whorl, and arch.

<table>
<thead>
<tr>
<th>LOOP</th>
<th>WHORL</th>
<th>ARCH</th>
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<tbody>
<tr>
<td><img src="image1" alt="Loop" /></td>
<td><img src="image2" alt="Whorl" /></td>
<td><img src="image3" alt="Arch" /></td>
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</table>

Other fingerprint patterns include:

<table>
<thead>
<tr>
<th>DOUBLE LOOP</th>
<th>TETRARCH</th>
<th>CENTRAL POCKET LOOP</th>
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</thead>
<tbody>
<tr>
<td><img src="image4" alt="Double Loop" /></td>
<td><img src="image5" alt="Tetrarch" /></td>
<td><img src="image6" alt="Central Pocket Loop" /></td>
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Identify the pattern on the fingerprints below.

<table>
<thead>
<tr>
<th>Pattern:</th>
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</thead>
<tbody>
<tr>
<td><img src="image7" alt="Pattern 1" /></td>
<td><img src="image8" alt="Pattern 2" /></td>
<td><img src="image9" alt="Pattern 3" /></td>
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</table>

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<tr>
<th>Pattern:</th>
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<tbody>
<tr>
<td><img src="image10" alt="Pattern 4" /></td>
<td><img src="image11" alt="Pattern 5" /></td>
<td><img src="image12" alt="Pattern 6" /></td>
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</table>

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<th>Pattern:</th>
</tr>
</thead>
<tbody>
<tr>
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<td><img src="image14" alt="Pattern 8" /></td>
<td><img src="image15" alt="Pattern 9" /></td>
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</thead>
<tbody>
<tr>
<td><img src="image16" alt="Pattern 10" /></td>
<td><img src="image17" alt="Pattern 11" /></td>
<td><img src="image18" alt="Pattern 12" /></td>
</tr>
</tbody>
</table>
Classifying Fingerprints

Bifurcation: The forking, or dividing, of one line into two or more branches.

Core: The approximate center of the finger impression.

Delta: That point on a ridge at or nearest to the point of divergence* of two lines. Resembles a Greek delta (▲)

*Divergence: The spreading apart of two lines which have been running parallel, or nearly parallel

Short break: Where a ridge stops and starts
Island: Ridges that split and come back together
Ridge end: Where a ridge stops and does not restart

Label the parts on the fingerprints below.
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<thead>
<tr>
<th>Field</th>
<th>Value</th>
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<td>First Name</td>
<td>NaN</td>
</tr>
<tr>
<td>Middle Name</td>
<td>NaN</td>
</tr>
<tr>
<td>Signature of Person</td>
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</tr>
<tr>
<td>Aliases</td>
<td>AKA</td>
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<td>Residence of Person</td>
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<td>Date</td>
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<td>Signature of Official</td>
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<td>Your No.</td>
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</tr>
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<td>Right Index Print</td>
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</tr>
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</tr>
<tr>
<td>Right Middle Print</td>
<td>NaN</td>
</tr>
<tr>
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<tr>
<td>Right Ring Print</td>
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<tr>
<td>Left Little Print</td>
<td>NaN</td>
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<tr>
<td>Right Little Print</td>
<td>NaN</td>
</tr>
</tbody>
</table>

**Instructions:**
- Left four fingers taken simultaneously
- Right four fingers taken simultaneously
Lab Procedure

Lab 1. Part 1: Rolling Prints

1. Wash hands thoroughly with soap and water and dry completely before beginning. Excessive oil from fingers or water on fingertips will affect the quality of the print.

2. Work in pairs or groups of three. One person will have their prints taken, while another will be rolling their prints. If working in groups of three, allow one person to have their prints taken, and the two other individuals will roll the prints for each hand.

3. Instruct the individual who is having their prints rolled to look away from the fingerprinting pad and paper, not to try to help in the fingerprinting process, and to relax.

4. Hold the individuals right hand at the base of the thumb with your right hand. Cup your hand over the individual’s fingers, tucking under those fingers not being printed.

5. When rolling the thumb in ink, remember that ink should cover the thumb from the edge of the nail to the other and from the crease of the first joint to the tip of the finger. Applying light and even pressure to the thumb, start at the edge of the nail and roll the thumb counter-clockwise (right to left) to the other nail.

6. Repeat this motion on the fingerprint card. In the R. Thumb box, set down the individual’s thumb at the edge of the nail and roll counter-clockwise across the paper to the other edge. Be careful to lift each finger straight up after rolling to avoid smudging.

7. Repeat these steps for all fingers on the right hand, but change the direction you are rolling. For fingers on the right hand, make sure you are rolling clockwise (left to right) from edge of nail to the other.

8. For the left hand, start again with the thumb and follow the same steps, with the only change being the direction of rolling. When rolling the thumb from the left hand, roll in a clockwise direction. When rolling the rest of the fingers, roll in a counter-clockwise direction.

9. To record prints at the bottom of the card, apply a small amount of ink to the surface of each finger on the right hand. Holding the person’s wrist, simultaneously press their fingers flat on the card without rolling the hand. Additionally, ink a flat print of the thumb.

10. Repeat for the left hand.

Tips:

- Refer to the “Quality Prints Diagram” on the Glossary page for images of poor quality prints.
- Do not apply excessive pressure when rolling a fingerprint! Generally, the weight of the finger is the maximum pressure needed to clearly record a fingerprint.
- When you are having your prints rolled, do not try to help roll your finger or press it down. Look away and allow the other person to do all the work. When a subject tries to “help” with rolling their fingerprints the print is typically smudged or unevenly rolled.
- The direction of rolling is usually considered “awkward to comfortable”. The beginning position of rolling a fingerprint usually feels a little uncomfortable. If it feels comfortable at the beginning the print is likely being rolled in the wrong direction!
- The easiest way to clean ink from your fingers is by using hand sanitizer and a paper towel. Soap and water may also be used, but the ink is unlikely to come off as easily.

Lab 1. Part 2: Examining Prints

1. Once you have completed rolling your fingerprints, carefully examine your fingerprint cards and set them before you.

2. Look for the overall pattern (loop, whorl, or arch).

3. Examine the ridges of the fingerprint itself and look for places where the ridges merge together, split apart, where there is a hook off the main ridge, etc.

4. Fingerprint examiners look for 12–15 unique features per finger. Choose one of your fingerprints and find and record 10 to 12 unique features.

5. The Henry Classification System allows for a logical categorization of ten-print fingerprint records based on pattern types. The Henry System assigns a numerical value to each finger with a whorl pattern. Look at the chart on your Data Collection Sheet to see the values assigned to each finger if it
Lab Procedure

contains a whorl. Determine your Henry Classification number using the appropriate numerical value if a whorl is present. If a whorl is not present assign a zero to that finger. Add up the numbers on the top and the bottom (along with an additional 1 in both the top and the bottom) to get your Henry Classification number.

Lab 2: Dusting for Prints

1. Clean your hands thoroughly with hand sanitizer or soap and water. Make sure to dry your fingers completely.

2. Once fingers are clean and dry, touch your index and middle fingers from each hand to the side of your nose or on your forehead at the hairline.

3. Without touching anything else, press your fingers (the ones you touched to your face) onto a window, a dry erase board, or an overhead transparency sheet.

4. Take your brush and dip it into a small amount of dusting powder in your weighing boat. Lightly tap the brush over a piece of paper so that any excess powder falls off of the brush. NOTE: Excessive powder can contaminate the prints.

5. As lightly as possible, brush a small amount of powder across your fingerprints with short and quick strokes. NOTE: Excessive pressure will wipe away part of the print.

6. Carefully examine the four prints you dusted and select the best print to lift.

7. Peel apart the hinge lifter and press one side to the dusted print. Do not rub the hinge lifter on the print; press gently on the print in one solid motion to adhere to the dusting powder on your print.

8. Pull the tape away from the print in one quick and fluid motion, then carefully press the two ends of the hinge lifter together to preserve your print. Again, be carefully not to rub the print.

9. Write your name at the bottom of the hinge lifter.

10. In your group, trade hinge lifters with another group. Take out your fingerprinting card from the previous lab and fold over the top so that no one can see your name. Trade those with the same group that has your lifted prints.

11. In your group, without looking at the name, try to identify which lifted print matches which card. Look for unique features to help discern between the different prints.

12. Once you have matched the print to the card, examine the prints on the card and the hinge lifters.

13. On your data collection sheet, record at least 12 unique characteristics about your classmate's fingerprints. If time permits, trade the prints and cards with another student and try to match the lifted prints to cards again.

Lab 3: Examining the Evidence

A print has been lifted from the safe at the office of the Tumbling Water Land Development Company, and investigators wish to identify to whom the print belongs. Detectives have pulled the fingerprint records of Lyle and Louise Mondelo, as well as the fingerprint records of John Wayne Gretzky.

1. Look at the evidence print. Determine the overall pattern.

2. Examine the ridges of the fingerprint itself and record at least 12 unique characteristics about the suspect fingerprint.

3. Next, look at the fingerprint cards of Lyle and Louise Mondelo and John Wayne Gretzky.

4. Use the knowledge you have gained about fingerprint patterns and a variety of unique characteristics to see if the evidence fingerprint matches any of the fingerprint cards.
# Fingerprint Analysis Data Collection Sheet

## My Fingerprint:

<table>
<thead>
<tr>
<th>Right</th>
<th>Class</th>
<th>Left</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little Finger</td>
<td></td>
<td>Little Finger</td>
<td></td>
</tr>
<tr>
<td>Ring Finger</td>
<td></td>
<td>Ring Finger</td>
<td></td>
</tr>
<tr>
<td>Middle Finger</td>
<td></td>
<td>Middle Finger</td>
<td></td>
</tr>
<tr>
<td>Index Finger</td>
<td></td>
<td>Index Finger</td>
<td></td>
</tr>
<tr>
<td>Thumb</td>
<td></td>
<td>Thumb</td>
<td></td>
</tr>
</tbody>
</table>

Fill in the chart below with your own values and add them together to determine your Henry System score.

\[
\begin{array}{cccc}
\quad & \quad & \quad & +1 \\
\quad & \quad & +1 & \quad \\
\end{array}
\]

= \_

## My Classmate's Fingerprint:

<table>
<thead>
<tr>
<th>Right</th>
<th>Class</th>
<th>Left</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little Finger</td>
<td></td>
<td>Little Finger</td>
<td></td>
</tr>
<tr>
<td>Ring Finger</td>
<td></td>
<td>Ring Finger</td>
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<td>Middle Finger</td>
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<td>Middle Finger</td>
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<tr>
<td>Index Finger</td>
<td></td>
<td>Index Finger</td>
<td></td>
</tr>
<tr>
<td>Thumb</td>
<td></td>
<td>Thumb</td>
<td></td>
</tr>
</tbody>
</table>

## Evidence Fingerprint:

**Overall pattern or class:**

**Unique features:**


Post-Lab Questions

1. What is the proper technique for rolling a fingerprint? Where do you start and end on each finger?

2. When rolling prints from your left hand, which way do you roll your fingers and thumb?

3. Describe the proper technique for lifting a print.

4. What was the most common unique characteristic you recorded from the fingerprints that you examined?

5. Of all the fingerprints you examined, what was the most common overall pattern?

6. What technique or process did you use when comparing prints to given fingerprint cards?

7. Who did the evidence fingerprint belong to?