Read the introduction on page 134 of your text and the scenario below. Answer the questions in pairs.

It is your first year at college and there is a break-in at the dorm. Fingerprints have been left at the crime scene. Based on this evidence, you are brought in for questioning.

1. If the police are accusing you of stealing the missing items from the dorm based on the presence of your fingerprints, what arguments could you present to support your innocence?

2. What could your arguments be if you do not know the person whose room was broken into or if your prints were found in a dorm other than your own?

Chapter 6  Fingerprints
By the end of this chapter you will be able to:

- discuss the history of fingerprinting
- describe the characteristics of fingerprints and fingerprinting minutiae
- explain when and how fingerprints are formed
- describe what causes fingerprints to be left on objects
- identify the basic types of fingerprints
- describe how criminals attempt to alter their fingerprints

Historical Development

1. In ancient Babylon (dating to 1792-1750 B.C.), fingerprints pressed into clay tablets marked contracts.
2. The oldest known documents showing fingerprints date from third century B.C. China.
3. The earliest written study (1684) is Dr. Nehemiah’s paper describing patterns he saw on human hands under a microscope, including the presence of ridges.
4. In 1788, Johann Mayer noted that the arrangement of skin ridges is never duplicated in two persons. He was the first known scientist to recognize this.
5. Jan Evangelist Purkyn described nine fingerprint patterns in 1823.
6. Sir William Herschel in 1856 began collecting fingerprints & found they were not altered by age.
7. In 1879, Alphonse Bertillon created a system to identify criminals, first used in 1883 to identify a repeat offender.
9. In 1891, Iván (Juan) Vucetich improved fingerprint collection. He noted measurements on identification cards, as well as adding all ten fingerprint impressions. He also invented a better way of collecting impressions. 10. Beginning in 1896, Sir Henry (same as #8), with help of two colleagues, created a system that divided fingerprints into groups. Along with notations about individual characteristics, all ten fingerprints were imprinted on a card (ten card - form used to record and preserve a person's fingerprints).
10. 1902 Bertillon solved 1st murder using fingerprints
Create a history timeline. You must include the eleven items for fingerprinting history in your notes. You must also include at least five additional historical events relating to fingerprinting and three other (general) historical events that occurred from 1788 to 1902. The other historical events can be scientific, political, etc. (You will have a total of 19 events on the timeline).

Events must be in order and NEAT.

*** Color code the timeline with one color for the events in the notes, one color for the additional fingerprinting events, and a third color for the general historical events.

What Are Fingerprints?

- All fingers, toes, feet, and palms are covered in small ridges.
- These ridges are arranged in connected units called dermal, or friction, ridges.
- These ridges help us get or keep our grip on objects.
- Natural secretions (water, oil and salts) plus dirt on the skin leave behind an impression (a print) on those objects with which we come in contact.

Formation of Fingerprints

- An animal’s external tissue (skin) consists of an inner dermis and an outer epidermis.
- Creation of fingerprints occurs in the basal layer in the lower portion of the epidermis where new skin cells are produced.
- Fingerprints begin forming around the start of the 10th week of pregnancy.
- Because the basal layer grows faster than the others, it collapses and folds, forming intricate shapes.

Characteristics of Fingerprints

- There are 3 general fingerprint distinctions:
  - ARCH About 5%
  - WHORL About 30% of the population
  - LOOP About 65%
Ridge pattern - recognizable pattern of ridges found in the end joints of fingers that form lines on the surfaces of objects in a fingerprint.

Arch - the ridge pattern originates from one side of the print and leaves from the other side.

Loop - the ridge pattern flows inward and returns in the direction of the origin; can be from left or right

Whorl - pattern resembles a bull's-eye; has two deltas

Characteristics of Fingerprints

Basic patterns can be further divided:
- Arch patterns can be plain (4%) or tented (1%).
- Whorl patterns can be plain (24%), central pocket (2%), double loop (4%), or accidental (0.01%).
- Even twins have unique fingerprints due to small differences (called minutiae) in the ridge patterns.
- minutiae - combination of details in the shapes and positions of ridges in fingerprints that make each unique; also called ridge characteristics

Arches
- Plain - ridges entering one side, rising in the center, and flowing out the other side without making an angle - has no characteristics of the loop pattern
- Tented - forms an angle and may possess some characteristic of the loop pattern such as a delta

*Basic patterns can quickly eliminate suspects, but to positively match a print found at a crime scene you must examine the minutiae.
- about 150 individual ridge characteristics on the average full fingerprint
*To match fingerprints, a minimum number of points of comparison are needed

Characteristics of Fingerprints

- Forensic examiners look for the presence of a core (the center of a whorl or loop) and deltas (triangular regions near a loop).
- A ridge count is another characteristic that distinguishes one fingerprint from another. The count is made from the center of the core to the edge of the delta.

Whorl Patterns
- Plain - one or more ridges make a circle and if a line is drawn between the two deltas, at least one ridge in the inner pattern is touched or cut by the line.
- Central Pocket Loop - one or more ridges make a circle and if a line is drawn between the two deltas, no ridges in the inner pattern are touched or cut by the line.
- Double Loop - two separate loop formations and two deltas
- Accidental - has two or more deltas and is a combination of two of the other patterns (but not a plain arch)

Types of Fingerprints

There are 3 types of prints to look for at crime scenes:
- Patent fingerprints are visible prints transferred onto smooth surfaces by blood or other liquids.
- Plastic fingerprints are indentations left in soft materials such as clay or wax.
- Latent fingerprints are caused by the transfer of oils and other body secretions onto a surface and are made visible by dusting with powders or the use of chemicals.
Read the scenario and write down where fingerprints may be found and what type of prints (patent, plastic, and/or latent) they would be.

Scenario: A local pottery studio was robbed while the owner was out. The thieves broke a window on the studio's front door and then reached inside the broken window, turning the doorknob to get in. Designs of vases and other items that the owner had drawn were strewn about the room. A fresh clay platter was torn in half. A cash register was forcibly opened, and all of the cash was taken. The criminals left simply by opening the back door.

Fingerprint Forensic FAQs

- How are latent fingerprints collected?
  - Dusting surfaces such as glasses, faucets, telephones with a fine carbon powder
  - Tape is used to lift and preserve the fingerprint
  - Tape is placed on an evidence card on which the date, time, location and collector of the print is logged
  - Prints must be photographed before they are lifted
  - Metal or magnetic powders can also be used and are less messy than carbon-based
  - Recovering a print from a surface that is not hard and smooth requires the use of chemicals

Chemical detection of latent prints

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Uses</th>
<th>Application</th>
<th>Latent Print</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ninyhydrin</td>
<td>Paper</td>
<td>Object dipped or sprayed.</td>
<td>Purple-blue print</td>
</tr>
<tr>
<td>Cyanoacrylate</td>
<td>Vapor</td>
<td>Heat sample in a vapor tent.</td>
<td>White print</td>
</tr>
<tr>
<td>Silver Nitrate</td>
<td>Wood</td>
<td>Object dipped or sprayed.</td>
<td>Black or reddish brown print under UV light</td>
</tr>
<tr>
<td>Iodine Fuming</td>
<td>Paper, cardboard</td>
<td>In a vapor tent, heat solid iodine crystals.</td>
<td>Brownish print (fades quickly)</td>
</tr>
</tbody>
</table>
IAFIS
- developed in 1999
- provides digital automated fingerprint searches, latent searches, electronic storage of fingerprint photo files, and electronic exchange of fingerprints and test results
- operates 24 hours a day, 365 days a year
- maintains Criminal Master File, largest database of its kind in the world
  - contains fingerprints and criminal histories for more than 47 million people
  - State, local, federal law enforcement agencies submit these data
  - Federal and state fingerprinting agencies do not pool their databases

The Future of Fingerprinting
- New scanning technologies and digitally identifying patterns may eliminate analytical mistakes.
  - scanned at the rate of 500 to 1000 dots/inch
  - image reveals minute pore patterns on the ridges
  - Material we touch leaves trace evidence on our fingers/hands, which is in turn left behind on the objects that we touch.
  - could provide information about the lives of people, not just their identities.
- To help with identification, other physical features such as retinal patterns in the eyes and facial patterns, and vein patterns on palms are also being studied.

Research wrongful convictions or court cases that have been reopened or thrown out because of faulty fingerprint identification. Working in pairs or groups of three, find at least 4 court cases and give the following information:
- brief description of the crime
- name of wrongly convicted, lawyers & real perpetrator
- other evidence against the wrongly accused
- when the court case occurred
- when the case was overturned if applicable

Create ten Jeopardy answers and questions for test review.
- must be in jeopardy format
- must include questions from history, formation, ridge patterns, minutiae, types of prints, IAFIS, and chemical detection.
- other categories can be future of fingerprinting, careers, etc.
- For history questions, focus on the order or matching the person to the event NOT the exact year (the only year you are responsible for is the year IAFIS formed).

Summary
- Fingerprints have long been used for identification, & in mid-1800’s were recognized as unique to each person.
- Three main groups include arches, whorls, & loops.
- Basic analysis includes looking for cores, deltas, and making a ridge count.
- Investigators search for patent, plastic, and latent prints.
- Dusting with powders or using special chemicals can make latent fingerprints visible.
- New developments may eliminate errors by analysts.