FLINN SCIENTIFIC

Fingerprint Background Information

What is a fingerprint?

Human skin (see Figure 1) represents the body's first line of defense against foreign invasion and infection. Skin is composed of an epidermal outer layer and a dermal inner layer. The surface between the epidermis and dermis is usually uneven, because the epidermis has ridges projecting inward and the dermis has finger-like papillae passing into the spaces between the ridges. This uneven boundary area is what contains the friction ridge structures responsible for our one-of-a-kind fingerprint patterns. These ridge patterns form during the fetal stage of development and remain unchanged throughout the individual's life.

Sweat glands are located in the dermis and their ducts extend up through the epidermis where they release perspiration, oils, and other materials through sweat pores. The perspiration, oil and salts from these sweat glands leave an identifiable residue conforming to the pattern of an individual's fingerprints.

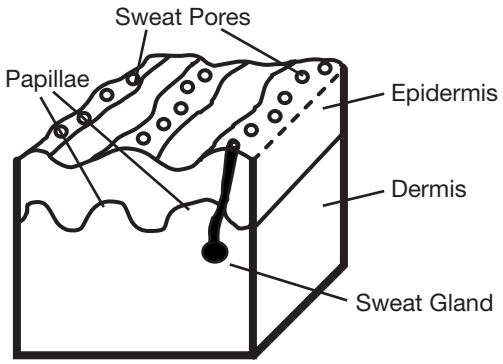

Figure 1. *Human Skin*

Fingerprint Patterns

There are three main fingerprint patterns, each having various sub-groups, found in the human population:

Loops (65%)	Whorls (30%)	Arches (5%)
Radial loop Ulnar loop Double loop whorl Accidental whorl	Plain whorl Central pocket whorl	Plain arch Tented arch

These fingerprint patterns are composed of many individual friction ridges.

A Loop pattern has one or more ridges entering from one side, curving, and then leaving the same side it began, as illustrated in Figure 2. Loop patterns always develop ridges that diverge to form a delta. It resembles a "Y" pattern. All loops must have one delta.

A Loop pattern on a fingerprint card that opens toward the thumb is a radial loop. A loop pattern that opens opposite the thumb is an ulnar loop, as shown in Figure 3. Remember, a fingerprint record is a mirror image of the actual fingerprint.

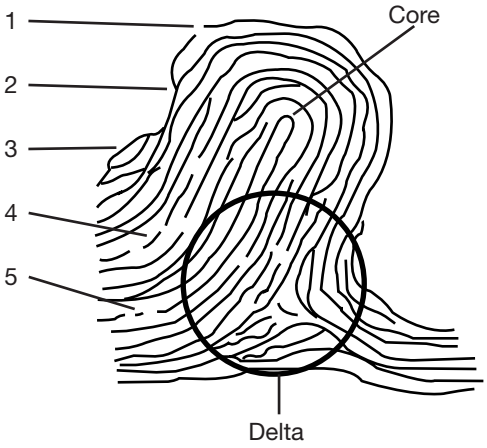

Figure 2. *Loop Pattern with Ridge Characteristics. Key: (1) Ridge Ending, (2) Bifurcation, (3) Enclosure, (4) Short Ridge, (5) Dot (Island).*

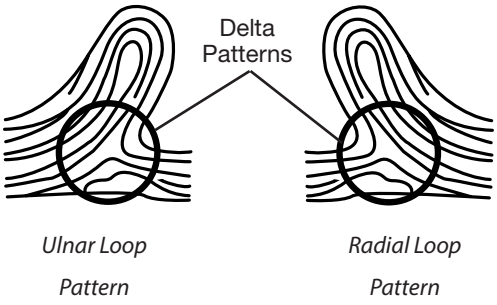

Figure 3. *Ulnar and Radial Loop Patterns on a left hand*

Whorls are friction ridge patterns that have a minimum of two deltas as illustrated in Figure 4. There are four whorl sub-groups: plain, central pocket, double loop, and accidental.

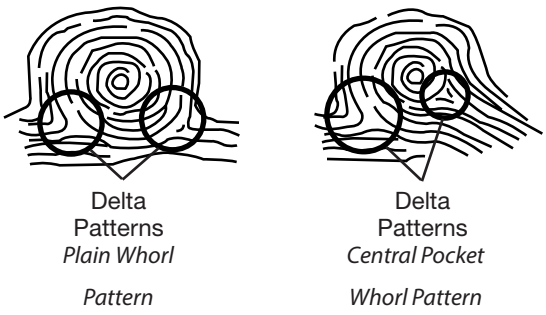

Figure 4. *Plain and central pocket whorl patterns*

The plain whorl has two deltas and a complete ridge circuit. It is almost a "circular" pattern. The central pocket whorl differs from the plain whorl in one of the delta areas as shown in Figure 4. The deltas are not symmetric and one side appears to be stretched like elastic (shown by the smaller circle).

The double loop whorl (Figure 5) is composed of two loops and two deltas. The last whorl sub-group is the accidental (Figure 5). This pattern is defined as a "pattern consisting of a combination of two different types of patterns, with the exception of the plain arch with two or more deltas or a pattern which possesses some of the requirements for two or more different types, or a pattern which conforms to none of the definitions."

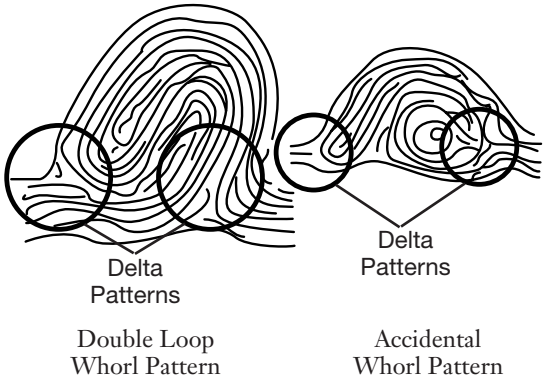

Figure 5. *Double loop and accidental whorl patterns*

Arches (Figure 6) are friction ridges that enter on one side of the finger and cross to the other side while rising upward in the middle. The simplest is the plain arch with mild bulging. The tented arch appears to have a spike acting as a pole in the middle.

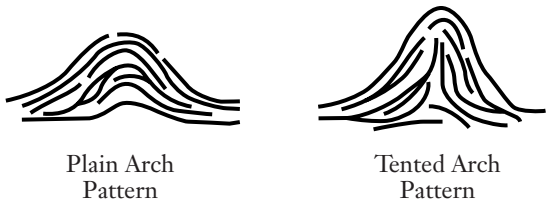

Figure 6. *Arch patterns*

Individual Ridge Characteristics

There are five ridge characteristics: bifurcation, short ridge, enclosure, dot (or island), and ridge ending as shown in Figure 7.

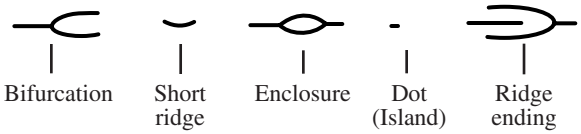

Figure 7. *Ridge Characteristics*

Fingerprint Classification

Fingerprints are analyzed and classified a number of different ways to expedite retrieval and identification. The recognition of the ridges, their relative number, and approximate location are key to identifying the print with the individual. There are at least 150 individual ridge characteristics on the average fingerprint. The greater the number of identical matching points on a fingerprint the greater the chances of the match. In a judicial proceedings a point-by-point comparison is usually made graphically to convince the jury of a match.

A preliminary classification method, which is only a very small part of the FBI classification method, is based upon whorl patterns of all ten fingers. The classification begins by identifying the presence of any whorl patterns. Whorl patterns are assigned a numerical value based on the finger on which the whorl is found. In this activity, however, the right thumb is the only print found at the scene.

Fingerprint Evidence Card

V

W

X

Y

Z

CS

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