TECHNIQUES IN FORENSIC SCIENCE

DACTYLOGRAPHY – FINGERPRINTING

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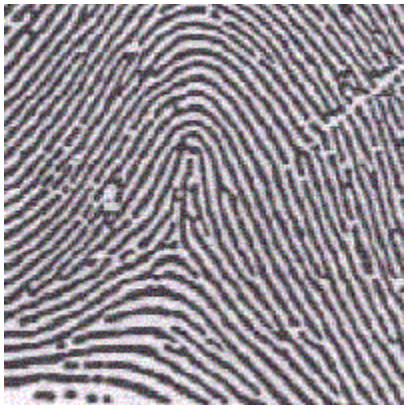
DACTYLOGRAPHY - FINGERPRINTING

- Also known as Henry Galton system of identification.
- Skin on the palmar and plantar surface is certainly wrinkled with narrow minute ridges that are known as friction ridges and is free from hair and sebaceous glands. However, there is profusion of sweat glands.
- Dermal carvings or fingerprints appear for the first time from 12-16 weeks of intrauterine life and gets completed by 24th week. These ridges do not change the course of alignment throughout the life of the individual until destroyed by mutilation.
- Fundamental principles of fingerprinting : First principle : Fingerprinting is an individual characteristic ; no two fingers have been observed to possess identical ridge characteristic.
- Second principle : A fingerprint will remain unchanged during an individual's lifetime. (Criminals have used some effort to change by mutilating the skin and such scars can also serve as identification marks)
- Third Principle : Fingerprinting has general ridge charcteristics that permit them to be systematically classified.

- Thumb prints were used as official seals or documents by Chinese emperors since 240 BC.
- The work of Grew (1684) and Biloo (1685) are among the earliest scientific descriptions of dermatoglyphics. Purkinjee (1823) also contributed significantly as he classified the varieties of finger patterns. W. J. Hershcel in 1858 began the first known use of in India on a large scale to prevent fraudulent collection of army pay accounts and for identification on documents. Francis Galton began in 1890 and published his book in 1892 on fingerprints and devised the first scientific method of classifying fingerprints.
- Juan Vucetich in 1891 installed fingerprint files for criminal identification based on the methods of Galton.
- First fingerprint bureau in the World was officially established in Calcutta in June 1897. In 1901 fingerprinting for criminal identification was officially introduced in England and Wales.
- Edward Richard Henry, IG of police in Lower Bengal did extensive study on fingerprints to develop a register for classification of fingerprints.
- System of Henry and Vucetich forms the basis of modern ten digit fingerprint identification.

CLASSES OF FINGERPRINTS



Classes of Fingerprints

- All fingerprints are divided into three major classes :
- Loops 60 – 70% (67%) : Ridges start on one side then run parallely and end on the same side. May be medial (ulnar) loop or lateral (radial) loop. The radial loop is the one which ends towards the radius bone (thumb side) and the ulnar loop is towards the little finger (the ulnar bone). Usually seen on forefingers.
- Arches 5 – 10% (6-7%) : Ridges start on one side and after a backward course end on the opposite side. Two types Plain arch and Tented arch.
- Whorls 30-35% (25%) : Multiple cirular or oval ridges one around another. Plain whorls, Central Pocket Whorls, Double Loop Whorls, and Accidental Whorls.
- Composite 1-2% : Combination of more than one pattern.
- Accidental : No specific ridge pattern

Characteristics of Fingerprints

- Each fingerprint may be different from each other but they all have some common characteristics among themselves.
- 1. Pattern area : It is that part of a loop or whorl in which appears the core, deltas and ridges with which we are concerned in identifying.
- 2. Type line : Are ridges that determine the pattern area of loops and whorls. Arches lack presence of type line.
- 3. Delta or triradius : It is formed when a ridge bifurcates and the two arms of the bifurcating ridge diverge or when two adjacent ridges running side by side diverge causing an interspace within which the pattern lies.
- 4. Core : Core is the central portion of the pattern and the type of core varies with the type of pattern.
- Types of Fingerprints obtained at the scene : 1. Visible prints : Visible to the naked eye for example blood print, ink print, colour print, paint print, dirt print and can be photographed. 2. Plastic prints : Formed when the fingers come in contact with soap, butter, wax, soft putty, tar, grease or freshly painted surface. They should not be photographed or dusted with powder. 3. Latent prints : These are impressions not visible to naked eye. This invisible image is left behind due to perspiration and sweat glands become active when the perpetrator is nervous or excited and hands sweat more than normal. He/she leaves behind a print on whatever surface they touch during the act. These latent prints can be detected by converting to visible prints through powders or chemical sprayer solutions and photographed and preserved.

Printing of Fingerprints

- Fingerprint impressions obtained are a reverse of actual pattern on the skin surface. Material needed are Printer's ink , paper or card, inking slab, inking rubber or cotton pad, benzene, alcohol, kerosene or gasoline and soap. Fingerprint impressions can be obtained as :
- 1. Rolled impressions : By nail to nail rolling of fingers
- 2. Plain or dab prints : These are unrolled impressions obtained by direct contact.
- Fingerprint Classification System : Battley system is the most famous through which the fingerprint impressions are transformed into a formula to facilitate the recording and searching of fingerprints. In the ten digit system it is analyzed under the following 7 systems : 1. Primary classification system : Scores are allotted for presence of whorl pattern in different fingers of each hand. i) Whorl in rt thumb or rt index finger – 16 scores ii) Whorl in rt middle or ring finger – 8 scores for each iii) Whorl in rt little finger or left thumb – 4 scores iv) Whorl in left index or middle finger – 2 scores v) Whorl in left ring or left little finger – 1 score vi) Fingers where no whorls – No scores.
- Scores are arranged as : R.T + R.R + L.T + L.M+L.L+ 1/R.T+R.M+R.L+L.I+L.R+1
- 1 is added for purpose of calculation. The total score of numerator is multiplied by denominator.
- 2. Major division system 3. Secondary classification system 4. Sub-secondary system 5. Second sub-secondary system 6. Final classification system 7. Key classification system. (For the right thumb only)

Latent Fingerprints

- Powdering and lifting latent impressions : Black or grey fingerprint powder is adequate. For light coloured and white objects black powder should be used and grey powder for black or dark coloured backgrounds. Aluminium powder is used as substitute for grey powder.
- Dragon's blood a natural powder may be employed on both dark and light coloured surfaces. On multicoloured surfaces a fluorescent type of powder is used for developing latent prints.
- Magnetic brush and powders are used to increase efficiency of developing latent prints. Should be used with magnetic powders only which are available in many colours grey, black, red, yellow, etc.
- Two types of lifting medium employed are : Transparent cellulose tape in 1.5 or 2.0 inch width rolls and Opaque rubber lifter.

Chemical Methods of developing latent prints

- Perspiration consists of 98% water with traces of salts like sodium, chloride, sulphates, phosphates, carbamates, lactic acid, fatty acid, glucose and urea. Chemical methods make use of the presence of chlorides which will react with chemicals and make prints visible. Following are used : 1. Iodine method – Iodine fumes react with fatty acids, ridges appear yellowish brown or brownish against background. Used for old prints. 2. Silver nitrate method – Sodium chloride reacts with silver nitrate to form silver chloride, which is unstable white substance and darkens on exposure to light and appears reddish brown. 3. Ninhydrin method – Reacts to amino acids and gives purple reddish brown stains. 4. Osmium tetra-oxide method : Used for recent prints, osmium tetraoxide is reduced to free osmium in presene of fatty acids that is dark in colour.
- 5. Chemical print method : Trade name in aerosol type container spray.
- 6. Hydrofluoric method : On glass, waxy substance of the print itself repels the fluid. 7. Tannic acid method 8. Osmic acid method 9. Mercuric iodide method 10. Bromine method 11. Reduced agents like amidol, pyrogallor or hydroquinone 12. Fleming's reagent method – Mixture of osmic acid, chromic acid and glacial acetic acid is exposed to diazine fast yellow dye that fluoresces in UV light.