1913-2013
THE FINGERPRINT
100 YEARS IN THE SERVICE OF THE SWISS CONFEDERATION
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The first centralized fingerprint collection in Switzerland for use in combating crime was established in 1913. It proved to be a worthwhile measure, not least because fingerprints secured at a crime scene identify people beyond doubt. Doubt is the antagonist of safety. According to Maslow’s hierarchy of needs, safety ranks second (after physiological needs) among a person’s fundamental needs.

Fingerprinting has come a long way over the past century, especially after fingerprint identification became computerized in 1984, the year the Automated Fingerprint Identification System (AFIS) was introduced. AFIS has been instrumental both in substantially reducing the time required to search databases and in augmenting the number of hits, that is, matching fingerprints found in cross-checking an AFIS database. Customer/client focus, data protection, quality management, cost-benefit analysis, and greater efficiency—these notions have become firmly established in the daily operational work of our AFIS DNA Services. There is no denying that technical development has left its mark on the science of fingerprints. Yet, and notwithstanding what popular television series like “CSI: Miami” would suggest, it is not technology that guarantees success in our work, but the women and men who are committed to the science of fingerprints. My respect goes to all of my colleagues who in the past one hundred years have been passionate about fingerprints. And my thanks go to all my colleagues who, today and in the years to come, despite ever-growing expectations and time demands, understand their work to be a mélange of art and craft.
Criminals have traditionally had a vested interest in hiding their identity. Identifying criminals has therefore always been a key factor in combating crime. Identification by means of fingerprints, also referred to as dactyloscopy, became the first truly reliable and effective tool for establishing a person’s identity. Fingerprint identification is based on the facts that the epidermal ridge patterns on the palms and the soles of a person’s feet are unique and do not change with time. Thanks to fingerprint identification, people who conceal their identity or make false statements about their identity can be identified quickly by cross-referencing their fingerprints against hundreds of thousands of fingerprint records stored in fingerprint databases. Popular American television crime series like “CSI: Crime Scene Investigation” have increased public awareness of forensic science and the work of criminal forensic scientists. But these series tend to present an exaggerated portrayal of forensic science; almost anything seems to be feasible and in no time at that. Scientific reality is slightly different, however. Nevertheless, thanks to such television programs, fingerprint identification has received renewed public attention.

Whenever we touch an object with our fingers or hands, we leave a print very much like a rubber stamp leaves a mark on a surface. Body fluids like sweat and other human secretions from the pores of the skin serve as stamping ink, so to speak. Offenders may be identified by a fingerprint or a set of prints they have left at a crime scene, provided their fingerprints are already on record. Fingerprints may provide the evidence necessary to clear a suspect from a charge or convict a suspect of a crime. The latter was the case when, for the first time in the Western world, a suspect was convicted of murder with the help of fingerprint analysis (see chapter 2.8). The fact that the human fingerprint is unique to a person and does not change with time makes it an ideal means of identification not only in law enforcement but also in civil matters; for example, fingerprints have long since been used in passports to identify their holder (see chapter 7).

The year 2013 marks the centenary of applied fingerprint science in the service of Swiss federal law enforcement authorities. This publication presents an overview of the biological underpinnings, the history and the methods of fingerprinting for criminal identification and the use of fingerprints as forensic evidence in court.

Bern, November 2012
1.1 THE SKIN

Skin is the soft outer cellular tissue covering the body of humans and other vertebrates. It is an extremely complex and versatile organ, appearing in two varieties: ridged skin, covering the palms and soles of the feet and meshed skin, the cornified layer of skin covering the other outer parts of the body. Ridged skin is most relevant for fingerprint identification.

Functions of the skin

The human skin has a surface of about 1.8 square meters. It has various functions, the most important of which are:

Protection

The skin, together with the various body fluids it secretes, is the body’s first line of defense against mechanical, physical, or chemical damage. The skin also doubles as a barrier against germs.

Water and heat balance control

The skin helps control body temperature by regulating blood circulation in the skin, thus preventing dehydration by excessive fluid loss.

Sensation

The skin contains many receptors sensitive to mechanical and thermal stimuli such as heat, cold, pain and pressure. These signals are transmitted to the brain. By way of example, the skin has about 250,000 cold-sensitive and about 30,000 heat-sensitive receptors.

Immune response

The skin plays a central role in helping the body respond to specific immunological threats.
The structure of skin

The human skin is composed of two primary layers: the epidermis and the dermis.

The epidermis, the outermost skin layer, is composed of up to five layers and varies in thickness depending on the region of the body. Among these layers are, in descending order, a cornified layer (stratum corneum), a granular layer (stratum granulosum), and – the lowermost layer – the stratum basale (basal layer), where tissue cells are reproduced (see figure).

Beneath the epidermis lays the dermis. The dermis is composed of a thick area known as the reticular layer and of a superficial area adjacent to the epidermis called the papillary layer, made of connective tissue papillae. These papillae (finger-like projections) are instrumental in the forming of friction ridges (raised portions of skin found on the palm and soles of feet). Two rows of papillae form a single papillary ridge (more often referred to as friction ridge). Sweat pores open between these ridges. These ridges occur on fingers and feet, and determine the individual fingerprint.

The skin possesses great power of regeneration. Injury to the epidermis, such as cuts or burns, does not cause permanent damage. However, injury to the dermis results in irreparable damage, mainly because the germinal layer, where new tissue is constantly formed through cell division, is damaged.
1.2 Ridges Skin on the palms and Soles of the Feet of Primates

In the course of evolution, terrestrial mammals developed soft pads on their feet – paws. Hair growth in these pads gradually ceased and sebaceous glands disappeared in that area, but not sweat glands. These glands secrete body fluid used for additional traction.

In primates – members of the most developed and intelligent group of mammals, including humans, monkeys, and apes – ridges and furrows on the palm and soles of the feet act as friction pads.

1.3 Prenatal Development of Friction Ridges in Humans

Volar pads

About six weeks from conception, the embryo begins to develop hands. At first, the hands are shaped like paddles. Only rudiments of the fingers are recognizable. From the eighth through the tenth week, the fingers continue growing, and the embryo can extend its thumbs. Volar pads – tactile elevations on the palm – are readily recognizable and keep developing until the twelfth week. After that, these volar pads regress until the sixteenth week, while friction ridges begin to develop beneath the epidermis.
The position, form, and size of the volar pads affect the friction ridge pattern. Where these bumps occur, how the fetus moves around inside the womb and how fast and big the fetus grows all effect how the fingerprint patterns and ridges form and ensure the unique properties of fingerprints are never duplicated. Genetic factors also contribute to the development of friction ridges.

**Primary ridges**
From the eleventh week of gestation, the tissue on the underside of the epidermis of the fetus’s hand begins to thicken. Separate friction ridge units begin to morph into elevated lines, or epidermal ridges. Each pair of ridges is separated by a depression, or furrow, containing a sweat pore and a sweat gland.

By the end of about fifteen weeks, the primary ridges on the underside of the epidermis are completely developed, and the surface of the palms increases fivefold, a fact that contributes decisively to the uniqueness of the friction ridge patterns of a person. The ridges at the dermal-epidermal junction develop first, which is why they are considered primary ridges.

**Secondary ridges**
Approximately between the fifteenth and the sixteenth week, the development of primary ridges stops. At the same time secondary ridges, growing closer to the skin’s surface, begin to develop. Secondary ridges have no pores. These systems of ridges continue developing up to the fifth month. By that time friction ridges are recognizable on the surface of the fetus’s fingertips.

### 1.4 Immutability of Friction Ridges

Friction ridges patterns are immutable due to the structure and growth of the skin:

- The germinal layer - the layer connecting the epidermis and the dermis - regulates the uniform growth and the regeneration of the skin, an extremely complex process ensuring that skin is completely renewed about every four weeks.
- By the twenty-fourth week, the friction ridges are fully developed.
- From then on, the same friction ridge pattern is reproduced throughout the life of a person.
- However, injury to the germinal layer results in lasting scars, and the body cannot reproduce the original friction ridge pattern.
1.5 **UNIQUENESS OF FRICTION RIDGES**

Friction ridge patterns and pore configuration are unique to a person. No two persons – even identical twins – have fingerprints that are exactly alike, mainly for two reasons:

- The hands of a fetus grow fast and their surface increases in proportion to the rate of growth. While the hands grow, the primary ridges are being drawn apart; the new area thus created is filled out by further ridges.
- Physical stress (tension and compression) and psychological stress up to the twenty-fourth week of gestation.

1.6 **FINGERPRINT STUDY OF IDENTICAL TWINS AND GENETIC FACTORS**

It has long since been established that identical twins have an identical DNA profile. However, their fingerprints are clearly different. The question arises whether genetic factors have a bearing on ridge pattern development.

Most research shows that the fingerprints of identical twins share more similarities than those of relatives or unrelated persons do. This fact holds especially for the following factors:

- Basic ridge patterns
- Number of ridges (number of ridges in whorls and loops crossed by an imaginary line running from the core to the delta (see figure right).
- Sum total of minutiae (bifurcations, endings, hooks, lakes, islands)
- Sum total of simple minutiae (bifurcations and endings)
- Main creases of the palms

The closer two people are genetically, the more similarities there are. However, in close relatives or even in twins this does not seem to hold for the more complex minutiae of a fingerprint such as hooks, lakes, an intersection of bifurcations, ending points of islands, or the center point of the sweat glands. This is also true of the position of minutiae.
Research, especially on identical twins, indicates that both growth stress (random physical stress and tensions in the developing skin) and, to a lesser degree, genetic factors affect the configuration of a friction ridge pattern.


A HISTORY OF FINGERPRINTING

2.1 ASSYRIA AND BABYLON (2200–625 B.C.E.)

About 25,000 clay tablets were discovered in the ruins of Nineveh, an ancient Assyrian city on the Tigris River in modern Iraq. These tablets are estimated to be up to 4,000 years old.

Many of these tablets, written in cuneiform, contain the author’s name. An imprint of one of the author’s fingernails (supur) served as seal. Together with the imprint of the fingernail, an imprint of a part of the fingertip and the friction ridge skin was left on the clay. There are grounds for the assumption that the people of that time were well aware of the uniqueness of friction ridge patterns and therefore used fingerprints as a way of identification.
2.2 THE CHINESE EMPIRE

Qin-Dynastie, 247–207 v. Chr.

The emperor Qin Shi Huang (259–210 B.C.E.) acceded to the throne in 247 B.C.E. at the age of twelve. He conquered and unified the various Chinese kingdoms and thus became the first emperor of the unified Chinese empire that lasted without interruption from 221 B.C.E. to 1911 C.E.

Qin Shi Huang was the first ruler known to use fingerprints in clay as a seal on documents.
**Tang Dynasty (618–907 C.E.)**

Tang Xuanzong, after whom this dynasty is named, was emperor from 712 to 756 C.E. Paper and silk became increasingly popular at that time and were also used for drawing up documents. To certify their validity, it was standard practice in China to place an impression - either palmprints or fingerprints - on documents.

The Chinese historian Kia Kung-Yen, who lived under the Tang Dynasty, explicitly described a method referred to as “hua chi” (fingerprint) used to prevent identity scams.

**Song Dynasty (960–1278 C.E.)**

In the Song Dynasty, named after its founder, Taizu of Song, the Chinese already differentiated between numerous friction ridge patterns.

In the twelfth-century crime novel *Shui-hu chuan* (Outlaws of the Marsh), a husband authenticates a writing of divorce by stamping on it the impress of his hand smeared with ink. This circumstance suggests that fingerprints were already generally acknowledged as evidence in Chinese criminal procedure.

Over the centuries, using fingerprints for identification has become firmly established in China. It even has its place in palmistry and fortune telling. Whorl patterns (tou), for instance, are believed to bring happiness, loops (ki) disaster.

| 1 whorl: | You will stay poor. |
| 2 whorls: | Wealth lies ahead. |
| 3–4 whorls: | Open up a pawnshop. |
| 5 whorls: | Become a wholesaler. |
| 6 whorls: | You are predestined to become a thief. |
| 7 whorls: | You are a poor soul. |
| 8 whorls: | You feed on straw. |
| 9 whorls, 1 loop: | You need not work and you will have enough to eat to the day you die. |

Fundamental ridge pattern types [4] | Loop | Whorl | Arch
Fingerprints and ridge patterns have long been used in China as a means of identification and verification both in official matters and for private purposes. For example, baby hatches, which are known to have existed in Europe since the medieval times, were first recorded in China in 1869. However, sources hint that they already existed there much earlier in one form or another.

Mothers unable to cope with looking after their infant—for instance, out of poverty—could anonymously put their child through a door or flap in the outside wall of an orphanage, where the foundling would be taken care of. Apart from the entry date, the orphanage would also note the foundling’s ridge patterns. Mothers would do the same before relinquishing their babies. Once a foundling’s mother was out of misery and chose to reclaim her baby, she could return to the orphanage and, by describing her baby, the date she left it, and her baby’s ridge patterns, reclaim her child.

Beginning in the Han Dynasty (206 B.C.E.–220 C.E.), China maintained lively trade contacts with the whole of Asia using the Silk Route. Knowledge of fingerprinting thus spread throughout Asia by means of China’s trade. Although not to the extent as in China, using fingerprints for identification has been common in most of Asia for centuries, especially in Japan, Nepal, and India.

A caravansary traveling on the Silk Route. [8]
2.3 MEDIEVAL EUROPE

Fingerprinting for identification was unknown in the Europe of the Middle Ages and even for quite some time after. To identify repeat offenders other methods were used; for example, people convicted of a minor offense were branded on their foreheads or their ears were slit. But since repeat offenders were usually subject to capital punishment anyway, the question of identification often took care of itself.
2.4 MODERN AGE: EUROPE AND THE WESTERN WORLD

The ideals of the Enlightenment as proposed by Immanuel Kant, Jean-Jacques Rousseau, Voltaire, Montesquieu, and many more triggered the French Revolution, ending the monarchy in France in 1789. The champions of the Enlightenment who promulgated new ideas such as the importance of reason and equality made a mark on the entire Western world in other ways too. For instance, torture practices of the day and cruel forms of execution were increasingly challenged and gradually abandoned, and the Enlightenment led to penal reforms.

With the abolition of the practice of branding offenders the question arose how to reliably identify repeat offenders who conceal their identity.

"Liberty Leading the People", by Eugène Delacroix, 1830. [10]
2.5 FRANCE:
FROM EUGÈNE VIDOCQ TO ALPHONSE BERTILLON

Eugène François Vidocq

Eugène Vidocq had a dazzling career: a French adventurer and bon vivant who served in the army and spent time in prison, Vidocq made his way from crook to informer and from secret agent of the Paris police to director of a plainclothes unit within the Paris Police Department called the Sûreté. Napoleon Bonaparte made this unit a state security police force, the Sûreté National, and appointed Vidocq its head in 1811.

Vidocq’s method of person identification was simple and neat: he regularly visited the prisons to memorize the faces of the inmates and made his agents do the same. At the same time, Vidocq began setting up files of index cards containing names, aliases, physical descriptions, and arrest histories for every arrestee. An arrest card also included the description of the offender’s criminal specialty and his method of operation. Vidocq’s methods were adopted by police units in other countries.

Louis Jacques Daguerre

Vidocq’s methods and his index card system became an even more effective means of identification with the advent of photography. Named after Louis Jacques Daguerre, the daguerreotype process announced in 1839 was the first commercially successful photographic process.

The Paris police began collecting photographs of criminals beginning in 1874. Criminals’ response to these new police methods was not long in coming. To avoid being recognized on a photograph, all they had to do was change their outer appearance. Further means of identification were called for.
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Photos and fingerprints of two different people. [15]

Photos and fingerprints of the same person. [16]
Alphonse Bertillon

Alphonse Bertillon, a clerk in the Paris Prefecture of Police, was the first to propose a system of identification using measurements of parts of the body. He presented this method in 1879 and, after being successfully tested in a three-month trial period, it was taken up by the Paris police from 1882.

The Bertillon method was based on the question of how a person could be readily identified using objective characteristics. Bertillon found the answer in anthropometry, the scientific study of the measurements and proportions of the human body. He had a general familiarity with anthropological statistics and anthropometric techniques because of the work of his father, a physicist, statistician, and vice president of the Anthropological Society of Paris. Bertillon knew that certain body measurements do not change anymore once an adolescent’s physical growth is complete, that is, at the age of 20.

Bertillon developed a system based on eleven measurements taken of various parts of the body. Under this system, a person was put in one of three main categories based upon head size. These categories were further subdivided according to the dimensions of the width of the head, of the left middle finger, and so on down the line. By dividing each of the measurements into small, medium and large groupings, Bertillon could subdivide the dimensions of any single person into further distinct subcategories. The measurements were converted into an algebraic formula that referred to a single person, and recorded onto cards which also bore a photographic frontal and profile portrait of the suspect. The cards were then systematically filed and cross-indexed for easy retrieval.

The Bertillon system, also referred to as Bertillonage, helped see past the disguises and aliases assumed by criminals. Investigators used the
Bertillon system to determine if a suspect had been involved in previous crimes. By measuring an arrestee and cross-referencing the information with details of previously recorded persons, the police could determine whether the suspect was a first-time or repeat offender.

The Bertillon system proved successful in identifying repeat offenders. The Paris police identified about one thousand repeat offenders in 1904 alone by measuring their body. However, the system was too complicated and often too imprecise due to inaccurate measurement and was gradually replaced by the superior system of fingerprinting. Nevertheless, the Bertillonage remained in practice the world over, including Switzerland, for about two decades.
2.6 THE BRITISH EMPIRE: BRITONS’ CONTRIBUTION TO FINGERPRINTING

Under Queen Victoria, the British Empire comprised countries and territories around the globe, including India. In India basic knowledge of fingerprinting already existed, having spread there from China and Western Asia (see chapter 2.2).

William James Herschel

William Herschel, a British colonial officer, is credited with being the first European to recognize the value of fingerprints for identification. He worked as an administrator for the British East India Company in the Bengal region of India from 1858 to 1857, and later as an administrator for civil matters in the Hooghly district in the province of Bengal. Just as Europeans today have a hard time telling Asians apart, so too did the British during colonial rule. Native Indian employees took advantage of this fact to deceive their British employers, for example by purchasing a corpse and pretending that the dead had been employed by the British administration. The purported relatives then benefited from the pension of the deceased. Herschel also began fingerprinting convicts, so that their prison term could not be served by a hired impostor.

Herschel further noticed that natives impressed their fingerprints on documents to authenticate their transactions and that documents bearing such impressions were more readily accepted.

Herschel clearly recognized the advantages of fingerprinting to prevent identity scams, introducing this method in the Hooghly district,
to which he had been appointed magistrate. In 1877 Herschel suggested to inspector of jails that the practice of fingerprinting be used throughout the whole of the Bengal province, but his suggestion was not acted upon. Greatly discouraged by his superior’s negative reply and feebled by tropical disease, Herschel abandoned his plan and returned to England.

**Dr. Henry Faulds**

During the 1870s, a British physician, Dr. Henry Faulds, who traveled widely in India and worked in Japan, became interested in skin furrows after he discovered fingerprints on ancient pottery. He recognized the importance of fingerprints as a means of identification and soon after began extensive research, including many experiments to reveal the permanence and uniqueness of fingerprints.

In a letter he wrote in 1880 to Charles Darwin (1809–1882), a naturalist and the main proponent of the theory of natural selection, Faulds pointed out that fingerprints were unique to a person and that fingerprints left at a crime scene could be used to convict the offenders. Darwin, at an advanced age and in ill health, informed Dr. Faulds that he could be of no assistance to him, but promised to pass the letter on to his cousin, Francis Galton.

**Francis Galton**

Sir Francis Galton, a respected British anthropologist in the 19th century and cousin of Charles Darwin, did not at first take up Faulds’s ideas. Galton had a laboratory at the Natural History Museum in South Kensington, where he conducted anthropometric studies from 1885. In 1888 the Royal Institution asked Galton to prepare and give a lecture on the Bertillon system, a system Galton largely admired. His research acquainted him with Herschel’s findings on fingerprinting and soon convinced him that fingerprinting was superior to anthropometry for establishing a person’s identity.

Galton seriously began looking into the method of fingerprinting. After he had come across Herschel’s findings on the merits of fingerprinting, he got in touch with Herschel. Gratified by the recognition his work received, Herschel left his entire material at Galton’s disposal for further study. Thus Galton integrated the topic of fingerprinting into his lecture titled “Personal Identification and Description.”
Beginnings of Fingerprinting

An early experiment in fingerprinting

29 years interval

An early experiment in fingerprinting

54 years interval

The longest known proof of persistence.
First fingerprints taken 1859-60 by William James Herschel. Imprints of the same fingers and whole hand prints taken at different times. [24]
Galton recognized that three fundamental questions needed to be answered conclusively before the method of fingerprinting could be put into widespread practice:

- Are fingerprints truly immutable and unique to a person?
- Do fingerprint patterns offer enough specific characteristics to allow for the differentiation of hundreds of thousands of people?
- Can fingerprints be filed in such a way as to establish within a reasonable time frame whether someone has been previously fingerprinted?

Following comprehensive research, Galton was able to answer all three questions affirmatively. He presented his research in Finger Prints, a book published in 1892, and set forth a method of his own design for classifying fingerprints. This method is chiefly based on the number of deltas present in a given area of a fingerprint:

- Arch pattern: No delta
- Loop pattern: One right- or left-side inclined delta
- Whorl pattern: Two or more deltas

The method consists in putting the findings in an algebraic formula by attributing a specific figure (1, 2, 3, or 4 respectively) to each of the various delta patterns (no delta, right delta, left delta, or several deltas). The formula of a fingerprint card in which none of the ten prints show a delta thus reads 1111111111. The formula of a card in which only one of the ten fingers, that is, the pinky of the left hand contains a right delta, reads 1111111112, and so forth. All ten fingers taken together can combine to more than one million classification categories (4 to the power of 10 = 1048576).

On 21 October 1893, the British home secretary appointed a committee chaired by one Charles Troup to inquire into the method of registering habitual criminals in use at the time, how anthropometry worked, and how the new fingerprint method could be verified. The basic question was whether it would be best to adopt the anthropometric system proposed by Bertillon or the fingerprint method. Galton devised a system for analyzing, comparing, and filing fingerprints with the help of details found in a fingerprint. These friction ridge details, or points, have been named for him, Galton points.

Invited to speak about fingerprint identification, Galton tried to persuade the committee members of the advantages of the fingerprint method. However, Galton’s filing method was not fully developed, and the champions of the Bertillon method still had great leverage. The Troup committee concluded its investigation by recommend-
ing an approach that included elements of Bertillon’s and of Galton’s method. Thus, from 1895, criminals in England were both measured and fingerprinted.

Edward Richard Henry

Edward Richard Henry was appointed inspector general of police for Bengal province in 1891. There, he first became acquainted with anthropometry, a method he concluded was not satisfactory.

He read Galton’s book Finger Prints in 1893. Back in England in 1894, he paid a visit to Galton, who had a laboratory in Kensington. Galton, in his seventies by that time, provided Henry with much information including research by Herschel and Faulds. Henry also learned about the Troup Committee and became acquainted with fingerprint classification, a topic that had not yet been satisfactorily solved. He was intent on finding a solution to this problem.

Henry went back to India and assigned two Bengali police officers (Khan Bahadur Haque and Rai Chandra Bose) to study the classification problem. By the end of 1896, Henry’s team was successful in setting up a workable classification system. It consisted in a complex mathematical formula for classifying and organizing ten-finger prints according to the frequency of the basic patterns and further characteristics.

Each time a person was arrested, fingerprints were taken again, classified according to the system, and cross-referenced with existing fingerprint cards. Thanks to this system, fingerprint records could be searched and retrieved with relative ease and identity fraudsters be exposed. In referring to this classification system as the Galton–Henry system, Henry paid tribute to Francis Galton’s seminal groundwork on fingerprint classification. The only drawback in the Galton–Henry system was that it was unsuitable for identifying fingerprints secured at crime scenes.

In 1897, Henry applied to Her Majesty’s colonial administration to inquire into the advantages of fingerprinting over anthropometry. As the results were overwhelmingly in favor of fingerprints, fingerprinting was introduced to all of British India.

After the fingerprint method was tested successfully again, it was adopted in England in 1901. Henry was recalled to Britain to take up a position with New Scotland Yard, where he was in charge of introducing the system. Under the lead of the Home Office, New Scotland Yard became the central fingerprint authority for England and its colonies.
2.7 ARGENTINA: JUAN VUCETICH

Juan Vucetich emigrated from Croatia to Argentina when he was 24. He found employment at the La Plata Office of Identification and Statistics. In 1891, the local head of police charged Vucetich with establishing an anthropometric office. He also provided Vucetich with an issue of “Revue Scientifique”, a French scientific journal containing an article detailing Galton’s latest findings on the use of fingerprints as a means of identification. Within a few days, Vucetich had set up a fully operational anthropometric office.

After studying the article on Galton’s findings, Vucetich became convinced that fingerprinting was a more advantageous method of identification than Bertillon’s anthropometric method. The same year, Vucetich began collecting fingerprints from criminals and developed his own classification system. However, his superiors would not allow him to make official use of this method.
2.8 Fingerprint Evidence First Used to Solve a Murder Case in Argentina in 1892

An atrocious crime committed on 19 June 1892 in Necochea, at that time a dreamy seaport some 500 kilometers from Buenos Aires, would make Vucetich’s superiors think again about fingerprinting.

On that day, a boy and a girl were found murdered in their home on the outskirts of Necochea. The children had been born out of wedlock to Francisca Rojas, aged 27. Preliminary investigations by the local police revealed that late that evening Francisca Rojas, screaming, distraught and eyes wide open, had gone bursting into the house of her neighbors. They said she had groaned and whimpered, “My children ... my children ... he has killed them ... Velasquez!” Her neighbors rushed to Francisca’s shack, where they found her son, Ponciano Carballo, aged six, and Teresa, aged four, dead from massive trauma to their heads. When first asked what had happened that evening, Francisca Rojas told the local police officer that one Pedro Ramon Velasquez, an elderly farmhand, had been pestering her for some time to marry him. On the morning of 19 June, Velasquez had pestered her again, insisting on making her his wife, she claimed. She had made it clear to him, however, that she would never marry him because she loved someone else. She told the police he had threatened her and her children, and then finally stormed off in a rage. After that, she said, she had left to run an errand, leaving her children at home. When she returned later that evening, she had found her children dead, she maintained.

Despite undergoing rough, merciless questioning and being subjected to harsh interrogation methods, Velasquez kept protesting his innocence. While admitting threatening the children, he vehemently denied murdering them, even after the police left him tied beside the dead children overnight.

The police report on the murder reached police regional headquarters at the province capital, La Plata, on 8 July 1892. An inspector named Alvarez, whose supervisor happened to be Juan Vucetich, was dispatched to Necochea to assist the local police in their investigations. On arrival, he learned that the local police had no further clues about the circumstances of the murder. Alvarez quickly cleared Velasquez, who actually had an unshakeable alibi for the time of the murder but, for some reason, had not thought to mention it. In fact, Velasquez had been with friends of his at the time of the crime. Inspector Alvarez also established that Francisca Rojas’s true lover of had been heard saying condescendingly that he would indeed marry her, if it were not for the “brats.”
Tutored by Vucetich in the basics of fingerprinting, Alvarez inspected the scene where the crime had happened two weeks before. He noticed a bloody fingerprint on one of the wooden bedroom doorjambs. Since the mother had denied touching the children’s bodies and had not been seen with any blood on her hands on the evening of the crime, the fingerprint could have only come from the murderer. Alvarez cut out that section of wood and took it to police headquarters, where he rolled Francisca Rojas’s fingerprints and compared them with the fingerprint he had secured at the crime scene.

Alvarez had only a basic knowledge of fingerprinting, but using a magnifying glass, he was able to prove beyond doubt that the fingerprint secured at the crime scene was identical with Francisca Rojas’s right thumbprint.

Rojas was confronted with the evidence and confessed to murdering her children. She had been promised marriage by her lover, but her children were an obstacle to his marrying her, she explained. After crushing their heads with a stone, she tossed it into a well, and washed her clothes and hands – but obviously not before touching the tell-tale doorjamb. Francisca Rojas was convicted and sentenced to life imprisonment.

This case firmly established fingerprinting as a superior means of identification to anthropometry. Argentina was the first country in 1896 to officially substitute anthropometry for fingerprinting in criminal investigations. From 1905 Vucetich’s classification system was used all over South America. Dactyloscopy (from Greek daktulos, finger, toe and skopein, to see), a term Vucetich coined, meaning “the technique of comparing fingerprints”, became prevalent among experts.
While Vucetich further refined his fingerprinting method, Alphonse Bertillon fought vociferously against those who advocated fingerprint identification, propagating his anthropometric system instead. In a letter he wrote to Francis Galton in 1891, Bertillon noted that fingerprinting was too difficult for police officers to implement. Nonetheless, in 1894 he eventually incorporated parts of this method into his system, probably because he could not help recognizing the merits of fingerprinting. Although Bertillon was decidedly not a champion of fingerprinting, it was he who - paradoxically - became the first forensic expert in continental Europe in 1902 to succeed in revealing the identity of a murderer from fingerprints collected at the crime scene. Presumably, this success only contributed to Bertillon’s apprehension that the fingerprint method would sooner or later supersede his anthropometric system of identification. When in 1913 Juan Vucetich traveled all the way from Argentina to France to pay Bertillon a visit at his office, Bertillon, begrudging Vucetich’s success with his fingerprinting method, used foul language on him and shut the door in Vucetich’s face.

Bertillon’s zeal to prove the shortcomings of fingerprinting led him in 1912 to publish images of an illustration showing the fingerprints of two distinct persons. The prints were edited in order to mask dissimilarities, but with 16 points of similarity marked on the revealed areas of the prints. Bertillon acknowledged the masking in the paper and stated that if a larger area of the prints were considered, significant differences would appear which would prevent reaching a conclusion of identity. Bertillon’s point was to show that two persons could in fact share 16 common points and argued that the absence of dissimilarities is more important than the number of similarities when inferring the identity of individuals based on the examination of fingerprints.

Initially a 12-point standard – the minimum number of minutiae considered necessary for conclusive identification – was used in Great Britain until 1924, when the 16-point standard came to be recommended by New Scotland Yard following, acknowledging that the 12-point standard was insufficient.
2.10 THE THEFT OF THE MONA LISA IN 1911

In France the anthropometric method was replaced by the fingerprinting method only after Bertillon died in 1914. The theft of the Mona Lisa from the Louvre on 21 August 1911 was one of several catalysts. The theft could have been solved quickly, had the investigators followed proper fingerprinting procedure. This was not the case, however, and Leonardo da Vinci’s most famous painting – it had once decorated Napoleon Bonaparte’s bedroom – remained missing for almost two years. The theft triggered a chorus of outrage in France.

The theft was committed by Vincenzo Peruggia, a thirty-one year old handyman employed by the Louvre. Peruggia helped to mount and remove protective glass in front of paintings, and to frame and deframe paintings. Apparently, his employers at the Louvre were not aware of Perrugia’s sideline career as a petty criminal, otherwise, they would hardly have employed him. In fact, Peruggia had been on anthropometric record with the Paris police as early as 1909 for being a casual thief.

The Mona Lisa is a painting in oils on a poplar panel measuring 77 by 53 centimeters. Early in the morning of 21 August 1911, Peruggia removed the painting from its frame and smuggled it out of the museum. The museum was closed to the public that day, open to workmen only. At first, investigations included Peruggia as a suspect. Even Pablo Picasso, the later-to-be famous painter, was for some time suspected. In the course of wide-reaching inquiries, Peruggia’s flat was searched in vain. Peruggia had managed to hide the painting in his flat so well that the police did not find it. The director of the Louvre was dismissed over the scandal, and the theft made for front-page news for weeks to follow. Two years after the theft, on 12 December 1913, Perrugia, contacted Alfredo Geri, an antique dealer in Florence to sell the painting for half a million lire. Perrugia purported that he wanted to restore the Mona Lisa to Italy, from where Napoleon had stolen it. Geri pretended to agree to the deal, but not without previously informing the museum director of the Uffizi Gallery, the oldest and most venerable art museum in the Western world. The painting was to be handed over to Geri in Peruggia’s hotel room in Florence. Geri and the museum director, who accompanied him, verified the painting’s authenticity. Much to their surprise, it was obviously the real Mona Lisa. Under the pretense that they had to get the half million lire first, a handsome sum at that time, they left and alerted the police. Peruggia was arrested. The public response to the recovery of the painting was immense. Whereas Italian patriots demanded that “their” Mona Lisa remain in her native Italy for good, the Italian government vowed that it would return the painting to the Louvre, arguing that France had obtained the painting legally and the Louvre was its rightful owner. Before the painting was returned to the Louvre, it went on exhibition in Florence, later in Rome, and finally in Milan.
The painting was transported in a padded made-to-measure case and protected by a guard of honor. Afterwards it was returned to the Louvre with great pomp and circumstance.

When Peruggia was put on trial in Italy, the court agreed to some extent that he committed the crime for patriotic reasons and gave him a surprisingly lenient sentence. He was sent to prison for one year and fifteen days, but had to serve seven months only.

In retrospect, the Paris police could not but admit that a critical blunder had been made in the investigation of the theft. A fingerprint, actually the print of Peruggia’s left-hand thumb, was collected from the glass panel protecting the Mona Lisa while exhibited in the Louvre. However, the investigators had not compared that print with the prints recorded on the anthropometric card the police had started on Peruggia. There is some controversy on whether the card could not be found or whether no match was found because the card contained right hand fingerprints only. Another thesis has it that the investigators were simply not aware of the evidentiary value of this crime scene evidence. After all, their superior, Alphonse Bertillon, disdained fingerprinting as an investigative method and thus did little to propagate it among his staff. This might explain why little effort was made to compare the crime scene print with reference prints, an omission that would be inconceivable today.

When Bertillon headed the Department of Judicial Identity at the Paris police, it was customary from 1894 to only record three fingerprints on a person’s print card. From 1908 it became standard procedure to print ten fingers. Had the investigators run a fingerprint comparison immediately after the crime was committed, Peruggia would have been identified within hours of the theft.

After this investigative failure became public, criminal anthropometry suffered a tremendous blow in France. The police prefect of Paris, after visiting the Department of Judicial Identity, is said to have considered supplanting anthropometry by fingerprinting for identification. But the anthropometric method remained in place for some time only to be gradually superseded by fingerprinting after Bertillon died in 1914.

The Mona Lisa back at the Louvre [34]
2.11 FRANCE: EDMOND LOCARD

Edmond Locard, a French scholar and scientist, was a strong advocate of fingerprinting and a pioneer in general forensic science. Locard studied medicine, and later law, at Lyon. After receiving his degree in medicine, he became the assistant of French medical doctor Alexandre Lacassagne (1844–1921), often referred to as the father of modern forensic medicine, of the University of Lyon. Locard went to Paris to study with French anthropologist Alphonse Bertillon (1853–1914) and to understand the anthropometric system of criminal identification. Locard later visited the police departments of Berlin, Rome, and Vienna. His trip also took him to the United States where he visited the police departments of New York and Chicago. He finally returned to Lyon in 1910 after a visit to the Swiss criminalist Rodolphe Archibald Reiss in Lausanne, Switzerland.

The same year, the Lyon crime rate began to rise. Locard succeeded in convincing the police authorities of the advantages of a criminal laboratory for collecting and analyzing criminal evidence. He was provided with two attic rooms in the headquarters of the Lyon police department and two assistants, and started what became the first police laboratory for investigating criminals. Locard’s efforts soon paid off. In November 1910, he solved the very first case assigned to him, with the help of a fingerprint.
The evolution of the tripartite rule for fingerprint identification

1911  Edmond Locard established a 12-point rule. According to this rule, at least 12 homologous points of comparison, or minutiae, were sufficient for positive fingerprint identification. In other words, 12 minutiae must be present in a crime scene fingerprint and correspond with the minutiae in the reference print for a positive identification. Locard’s 12-point rule is widely used to this day.

1913  Locard published a treatise on poroscopy, the study of pores that appear in the fingerprint ridge, and their use in the individualization process. The following year, he published his conclusions on the identification process and the refined criteria to be used to assure reliability. His study showed the following tripartite rule summarized as follows:

If more than 12 concurring points are present and the fingerprint is sharp, the certainty of identity is beyond debate.

If 8 to 12 concurring points are involved, then the case is borderline and the certainty of identity will depend on nonquantitative, that is, non-numerical aspects such as:

– Sharpness of the fingerprints;
– Rarity of its type;
– Presence of the center of the figure (core) and the triangle (delta) in the exploitable part of the print;
– Presence of pores;
– Perfect and obvious identity regarding the width of the papillary ridges and valleys, the direction of the lines, and the angular value of the bifurcations.

If fewer than 8 characteristic points are present, the fingerprints cannot provide certainty of identification, but only a presumption.

Although established almost one hundred years ago, Locard’s rules are still very much topical. In addition to the 12-point rule, modern fingerprint research includes both poroscopy (the science of the placement, frequency and configuration of the pores on the friction ridges) and a non-numerical approach based on the use of probability (that is, the inclusion of other aspects such as rarity, the presence of pores, and other non-numerical aspects). Locard’s findings may be considered as milestones in the history of fingerprint science.
2.12 MONACO 1914

In April 1914, Prince Albert I of Monaco convened an international conference of senior police officials from various countries to lay the groundwork for international law enforcement cooperation. The Monaco conference was held under aegis of France. Neither England nor the United States sent delegates.

Alphonse Bertillon was invited to lecture on the advantages and disadvantages of anthropometry and fingerprinting and on the options of a uniform identification system. However, he died shortly before the conference began. A former assistant to Bertillon held the lecture instead. He spoke out in favor of fingerprinting and suggested establishing an international police agency with headquarters in Paris. The outbreak of World War I delayed carrying out the decisions taken at the conference.

The president of the Vienna police, Johann Schober, took up the proposal of establishing an international police agency in 1923 again. The International Criminal Police Commission (ICPC) was founded, with headquarters in Vienna. Johann Schober thus laid the foundations of what was to become Interpol (International Criminal Police Organization).

2.13 FROM MOUNTAINS OF PAPER TO INFORMATION TECHNOLOGY

In 1924, an act of congress established the Identification Division of the FBI. The division started a collection of fingerprint cards. The collection contains the fingerprints of criminals, private and military persons, foreigners, and employees of the U.S. defense industry. World War II contributed to the rapid growth of this collection. By 1946 it had grown to contain 100 million fingerprint cards. By 1964 the FBI had processed 172 hundred million cards. Files were maintained manually. An automated system for managing fingerprint files was needed to assist employees in their work.

The National Bureau of Standards—now the National Institute of Standards and Technology (NIST)—began researching possibilities of scanning fingerprint images, ridge pattern recognition, and fingerprint classification. Many specialized companies like Rockwell and Calspan, and research institutions contributed to developing minutiae-based fingerprint identification systems.
Other countries too were looking for an automated fingerprint search system solution, France among others. In 1967, the head technician of the Paris police prefecture, R. Thiebault, presented the Interpol assembly with a study on the electronic processing of fingerprints. His theoretical approach consisted in analyzing minutiae such as ridge endings and bifurcations, and in evaluating their relative position in relation to adjacent minutiae. His theories served as groundwork for an automated fingerprint processing system Morpho Company developed by order of the French police.

Canada and its Royal Canadian Mounted Police (RCMP) together with the United States FBI were among the pioneers and firm supporters of automated fingerprint systems. The Ottawa Royal Canadian Mounted Police purchased an Ampex Video File System in the early 1970s. The system contained more than two million fingerprint files. It recorded video images of fingerprints except the small finger. These images and the characteristics of a print, encoded in an algebraic formula, were stored on seventy-one 2-inch video magnetic tapes and filed according to a formula index system based on the main fingerprint patterns. Operating the Ampex system was rather cumbersome: magnetic tapes had to be fetched from storage rooms, mounted on the computer’s reading device, rewound to the beginning, and images copied. After that the tapes had to be rewound, dismounted, and returned to the storage room.

In an AFIS query, details such as the position and the direction of bifurcations and ridge endings and their mutual relation are analyzed and evaluated. [39]
Queries were run several times a day. They were grouped according to the formula index system, transferred on a punch card, and entered into the control computer that directed the operator to mount the corresponding magnetic tapes. The system searched the reference images on the master tape and copied them to a temporary tape, which the fingerprint expert could use to compare prints. The distinct reference prints were shown on split screen TV monitor and could then be compared with the original specimens.

The FBI awarded Rockwell International a contract to build five high-speed fingerprint reader systems. The first of these readers, called “Finder”, was delivered to the FBI in 1975. Except for the United States, this rather expensive system only sold well in Brazil. In 1974 Rockwell established Printrak, a division that developed the Printrak 250 system, a less pricey fingerprint reader system. By 1981 fingerprint readers of this system were used by eight police departments in the United States and by law enforcement agencies in Canada and Brazil, among others.

In 1981 Printrak was sold to the London-based Thomas De La Rue and Company, whose primary business was security systems and the printing of passports and currency. The new owner retained all staff and founded De La Rue Printrak with headquarters in California.
In 1982, De La Rue Printrak launched a new fingerprint identification system, the Printrak 300 System. Switzerland purchased this system for use by the Central Police Bureau at the Swiss Federal Attorney’s Office. The system went operative in 1984. By 1985, 29 Printrak systems were in use in numerous countries. After De La Rue Printrak had controlled most of the market for about a decade, three serious competitors emerged: the U.K.-base Logica plc, Morpho System of France, and NEC System of Japan.

In 1987 Printrak launched the AFIS-ISAR system, a novel system that made it possible to store and retrieve images on optical storage disks (Image Storage And Retrieval). The Printrak 250 and 300 systems were supplanted on the market in 1989 by the Orion fingerprint matching system, a new generation of automated fingerprint identification systems. After Printrak’s management bought the company from its mother company, De La Rue, in 1990, the Orion System began to sell big. Restyled Printrak International, the company was the market leader in the fingerprint business in 1991. The Orion System was continuously updated and improved, thus consolidating Printrak’s core business.

In 1993, the FBI awarded a major contract to upgrade the bureau’s National Crime Information Center. Printrak together with the Harris Corporation, an armament company, won the contract, outdoing five other competitors. In 1996 the AFIS 2000 System was launched. Four years later, Motorola bought Printak and launched the Omnitrak AFIS software. Eventually in 2009, Sagem Morpho, a French corporation, took over Motorola’s biometric division, Printrak.
3.1 THE RISE OF THE ANTHROPOMETRIC SYSTEM

Alphonse Bertillon introduced the anthropometric system for identification in France in 1882. The system, also referred to as the Bertillon system, met with instant success throughout the world and remained the method of choice for identification for some time. This system was also gradually adopted by the Swiss law enforcement authorities.

However, at first the Bertillon system hit a snag in Switzerland: While police structures in other countries were centralized with centralized police agencies and data collections, Switzerland’s decentralized law enforcement structure suffered the disadvantage that no centralized register existed. Lacking a centralized police bureau, the Bertillon system did not help identify repeat offenders active in more than one canton or abroad. A central data collection was called for.

Proposed at a conference of the Swiss police directors, a central police bureau headquartered at Bern was created by a Federal Council decision of 26 October 1903. Established under the designation of Swiss Central Police Bureau, this now defunct bureau was attached to the
Federal Police Division (now the Federal Office of Police), a division at the Federal Department of Justice and Police. (See annex 12.1 for an excerpt from the circular message by the Federal Council of 21 November 1905.)

The Swiss Central Police Bureau was responsible for:
- keeping a central anthropometric register;
- keeping a central criminal register; and
- publishing the Swiss Police Gazette.

After the referendum period had expired, the Swiss Central Police Bureau began operating in 1904. It was situated at Wildstrasse 3 in Bern, the same address where the Swiss Federal Office of Weights and Measures was housed from 1914.

The Central Anthropometric Register became operative on 1 April 1904, and the Central Criminal Register began offering services on 1 January 1905, the date from which also the Swiss Police Gazette was published regularly.

3.2 FINGERPRINTING IN SWISS LAW ENFORCEMENT: PROFESSOR RODOLPHE ARCHIBALD REISS

Professor Rodolphe Archibald Reiss founded the Institute of Forensic Science at the University of Lausanne in 1909. Affiliated to the Faculty of Forensic Law, this institute has left its mark on the history of fingerprinting in Switzerland and abroad.

In Switzerland, the first conviction based exclusively on fingerprint evidence was rendered by a Lausanne court on 31 October 1912. Following the burglary of the cafe in the Lausanne Kursaal, an elegant place incorporating a casino, restaurants and complimentary rooms, one Emile H. was arrested as a suspect. Fingerprints and palm prints secured at a door that had been forced open were analyzed by the institute headed by Professor Reiss and found to match those of Emile H. He was sentenced to one hundred days of prison and deprived of his civil rights for five years, meaning that he forfeited his right to vote or be elected to a public office during that period.

Fingerprint evidence was not always afforded such weight by the courts, however. In thirty other criminal cases where Professor Reiss and his team had succeeded in collecting fingerprint evidence - the earliest dating back to 1904 - the courts gave more weight to evidence other than fingerprint evidence.
Fingerprinting and the Galton–Henry system of classification were introduced at the federal level on 1 January 1913. Easier to employ and more precise than Bertillon’s anthropometric system, fingerprinting was to finally supplant anthropometry within about a decade.

A number of cantons began using fingerprinting much earlier:

<table>
<thead>
<tr>
<th>Canton</th>
<th>Year</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basel Stadt</td>
<td>1904</td>
<td>Alphabetical classification, later Daae (modification of Vucetich’s method)</td>
</tr>
<tr>
<td>Luzern</td>
<td>1905</td>
<td>Galton–Henry classification</td>
</tr>
<tr>
<td>Aargau</td>
<td>1908</td>
<td>Galton–Henry classification</td>
</tr>
<tr>
<td>Bern</td>
<td>1908</td>
<td>Test based on Daae’s suggestions (modification of Vucetich’s method)</td>
</tr>
<tr>
<td>Schaffhausen</td>
<td>1909</td>
<td>Galton–Henry classification</td>
</tr>
</tbody>
</table>

(See annex 10.1 and 10.3 for images of these documents)

Whereas most of the German-speaking cantons opted for the Galton–Henry classification for filing fingerprint cards, the French-speaking cantons predominantly adopted Vucetich’s classification. The practice of using different classification systems that varied from canton to canton continued well into the 1990s. With the advent of electronic data processing, fingerprint cards have been filed since 1996 mainly by assigning a process control number (PCN) from 1996, a tracking number that is issued after fingerprinting has been completed.

The term “Erkennungsdienst”, or identification service, was first used in Swiss federal legislation in 1914.

Since the Galton–Henry classification system did not allow conducting a pinpoint search and compare isolated crime scene traces to the corresponding fingerprints registered in a 10-finger reference collection, the Identification Service at the Swiss Central Police Bureau introduced a single-fingerprint collection in 1923 (Born system, a variant single-fingerprint classification system).
Essentially, the Galton‒Henry system consists in classifying the basic patterns of all ten fingers. This system has a major drawback, however: if only an individual piece of crime scene evidence is available, such as an isolated fingerprint, it is not possible to put the fingerprint characteristics into a formula appropriate for searching an entire ten-fingerprint collection. Friedrich Born solved this problem by introducing an ingenious single-fingerprint classification system in 1926. This system allows to convert the characteristics of each finger into a distinct formula and to search the database for an individual fingerprint. This formula incorporates not only the basic print patterns but also various subpatterns and details such as differences in shape, or the distance from a delta to the core of a print. The Swiss Central Police Bureau was affiliated to the Office of the Attorney General of Switzerland in 1929.
Fingerprints can be lifted from a substrate with the help of one of various adhesive media, such as gelatin fingerprint lifters. Until the end of World War II, the cantonal identification services and some foreign agencies, such as New Scotland Yard, purchased black gelatin lifters directly from Rudolf Schneider, a major Vienna-based manufacturer. These lifters are known as Vienna lifters or Schneider lifters to this day. After the Third Reich capitulated and Soviet troops marched into Vienna, these lifters were no longer available for purchase (see copy in annex 10.8). The Swiss identification services therefore began manufacturing their own from 1945. By then fingerprinting had become the standard way of identifying persons in Switzerland.

From 1945 to 1975 there were no further innovations in fingerprinting in Switzerland. In 1975 the Swiss Central Police Bureau moved headquarters from Wildstrasse No. 3 to a newly erected police building on Bundesrain No. 20, still in Bern. By that time, the Identification Service at the Swiss Central Police Bureau was managing about 400,000 fingerprint cards.
Specimen of a ten-fingerprint card, with a Galton–Henry classification formula in the upper right-hand corner. [48]
Defunct crime scene evidence hang files with tabs, arranged according to offenses. [49]

Entrance to the federal administration building on Bundesrain No. 20, Bern. [50]

Fingerprint card file cabinets at the new premises on Bundesrain No. 20, Bern. [51]
In the following years, the fingerprint collection of the Identification Service kept growing by an average of 16,000 cards a year. The fingerprints on these cards – half of which concerned foreign nationals – were secured at about 7,200 crime scenes. The whole identification process, from classification to filing, and from retrieving to comparing prints, was time-consuming business. Prints had to be stored by way of a manually maintained card index system. Besides maintaining a fingerprint master file collection, fingerprint examiners had to keep an alphabetically and phonetically arranged register containing a brief description of a fingerprinted person’s particulars. Searching a fingerprint card collection to identify a person took an average of thirty minutes.

Although the Galton–Henry classification system for filing existing fingerprints was useful for identifying repeat offenders, it was not helpful in apprehending criminals by identifying prints left at crime scenes, because it was not possible to match individual crime scene fingerprints with the corresponding prints on the ten-finger cards stored according to the Galton–Henry classification system. To search a Galton–Henry based system for a match, crime scene prints of all ten fingers had to be available. Contrary to popular belief, fingerprint reference collections based on the Galton–Henry classification system – a system that used the prints of all ten fingers – could not simply be pinpoint searched for a match to isolated or incomplete crime scene fingerprints. To sort through a fingerprint collection on the Galton–Henry system for a match, crime scene prints of all ten fingers had to be available. To address this limitation, single-fingerprint classification systems were developed.

Thanks to single-fingerprint classification systems, in which not all fingers are mounted on one single card but classified individually, a fingerprint collection could be searched for one specific print left at a crime scene. However, maintaining a collection of palmprints and a single-fingerprint collection where each print had to be mounted on a separate card was an extremely time-consuming process. After a person was processed, the ten-fingerprint cards had to be classified and filed separately, causing additional time-intensive work done especially in connection with offenders who were very active at one time. Searching such a collection was a tedious procedure, producing very few matches only. Systematic analysis and comparison of the prints on newly started fingerprint file cards with unsolved crime scene evidence was the most promising, nevertheless unsatisfactory, procedure to yield a match, that is, identify a criminal offender who had already been fingerprinted. Fingerprint examiners had to have a gift for remembering ridge patterns and other details in a fingerprint. Before filing a newly started ten-fingerprint card, they took a close look at the prints. Sometimes they happened on a pattern that looked familiar and they went sorting through their collection of cards, trying to match the fingerprints on the new card against the collection of prints.

Pierre Mouche, a fingerprint examiner with the Identification Service, comparing crime scene fingerprints against a ten-fingerprint card in the early 1980s. [52]
But such chance occurrences were exceptional, averaging once a month, and therefore cause for celebration. Matching crime scene fingerprints to a known offender remained a seldom occurrence. This changed when the Identification Service acquired an automated fingerprint identification system (AFIS) in 1984. This new technology triggered an unprecedented evolution in fingerprint processing (see chapter 5).

In 1997, at their annual conference in Solothurn in 1997, the heads of the forensic science services of Switzerland decided to phase out the 12-point numerical standard used for fingerprint identification (see chapter 2.11) and replace it with probability calculation using algorithms instead.

A national DNA database was run for trial from 2000. When this database went into full operation after a five-year transitional period, the AFIS Services became integrated into the new infrastructure and were renamed AFIS DNA Services.

At their annual conference in 2007, the heads of the forensic science services of Switzerland resolved to implement the decision made in 1997 to phase out the 12-point numerical standard. They followed the recommendations of a commission set up to investigate the benefits of using empirical probabilities for fingerprint analysis. The heads issued a declaration of intent regarding the training of fingerprint examiners and the analyzing process to be used in fingerprinting. In summary the revised 2012 version provides as follows:

Fingerprint specialists are to be trained in a three-tiered instructional process (basic, specialist, and expert knowledge). Their skills are subject to periodic review. In examining and evaluating fingerprints, fingerprint specialists are advised to take a probabilistic approach to form an opinion, taking into account not only a minimal number of corresponding Galton points, but also qualitative and quantitative features of identification. In identifying fingerprints and when verifying and checking findings, fingerprint examiners proceed hierarchically. Each analysis begins by differentiating between simple and complex cases. This kind of approach is based on the ACE-V method (Analysis, Comparison, Evaluation - Verification). The Committee of the Fingerprint Working Group is to coordinate the overall process.

This declaration ushered in the transition from the 12-point numeric standard—requiring a minimum number of Galton points, or minutiae, for conclusive identification—to an approach based on empirical probabilities. This empirical approach requires the fingerprint examiner to go beyond identifying and comparing minutiae to take into consideration quantitative and qualitative elements to effect identification.
5.1 FROM THE FIRST AFIS IN EUROPE TO THE LATEST OMNITRAK GENERATION

In 1976 Rockwell International, an American fingerprint systems manufacturer, approached the Swiss Central Police Bureau and provided specialists from the Identification Service and from the Swiss Attorney General’s IT department with an in-depth look into new fingerprinting technology.

Rockwell International offered to demonstrate a one-finger identification system in Frankfurt for European clients. In August 1976, the company requested the Swiss authorities to send it 100 fingerprinting cards of people who had been fingerprinted in Switzerland. These cards were scanned into a computer in California, and a trial database containing 1,000 individual fingerprints was set up. To make the trials as realistic as possible, sets of fingerprints whose basic pattern primarily contained a loop were used for the test. The results were promising, despite the fact that the system required about an hour for each search run. Following an in-depth report on the test results, a project proposal on acquiring an automated fingerprint identification system (AFIS) was submitted to the General Attorney’s Office and the now defunct Federal Office for Organization on 18 April 1977 and later approved. On 27 July 1977, the AFIS project management team was appointed to conduct a preliminary analysis and develop a concept for an automated fingerprint identification system for use by the Swiss Central Police Bureau.
It became clear on closer inspection that the systems used by the BKA, FBI and RCMP were unsuitable. The other two smaller systems, however, appeared to meet Switzerland’s needs and, in a test developed by the Swiss, proved that they could deliver the performance required. The AFIS concept was completed in 1980 and approved by the Federal Council, whereupon Switzerland put in an order for the Printrak 250 S system.

The system should provide:
- automated one and ten-finger identification;
- a computer-supported name index with terminals for the whole department; and
- a simple microfilm system for easy access to the fingerprinting cards contained in the master fingerprint collection that had to be recorded on microfilm.

The automated system should:
- be capable of processing of all incoming ten-fingerprint cards;
- be able to process all incoming trace evidence;
- provide a link between the name, search and register index with the library of photographs;
- offer fast consultation of original prints in case of a match; and
- cause no additional personnel resources

The concept stage was to include a market overview and, if possible, test the systems used by:
- the German Bundeskriminalamt (BKA);
- the U.S. Federal Bureau of Investigation (FBI);
- the Royal Canadian Mounted Police (RCMP); and by
- two agencies near Washington, DC, and Minneapolis/St.Paul.
Work began on registering the name cards in 1981: ten temporary workers and numerous staff from various cantonal identification services worked to clean up the fingerprint collections. Then the fingerprinting cards were each given a process control number, formatted according to the AFIS-compatible NCIC standard and copied onto microfilm.

In 1982, Rockwell International sold Printrak to the British company De La Rue. De La Rue made the new and more efficient Printrak 300 system available to Switzerland at no extra cost.

The Printrak 300 system was delivered in 1984 and work started on the data conversion. With great effort and the support of cantonal identification officers, the edited fingerprint collection was scanned into the three Printrak read/edit consoles and the new system was put into operation.

The data conversion was completed in mid-1985. The initial results confirmed the system’s capabilities. The database soon became of increasing use not only to the police, but also to the asylum authorities. The Office of the Delegate for Refugee Affairs, the predecessor of the Federal Office for Migration, began using the system to check the fingerprints of asylum seekers. Owing to the additional use of the system by the asylum authorities, the read/edit consoles could no longer be used to search for trace evidence and a further console was therefore added in 1986.
Until that time, possible matches were printed out on paper using the reference number of the 10-finger fingerprinting card. The corresponding fingerprint card was then retrieved on microfilm and compared with the traces from a crime scene by projecting the print onto a screen. After fingerprint processing increased strikingly in the field of asylum, the microfilm system was superseded by a time-saving image processor system with optical plates (Image Storage and Retrieval ISAR). This was to replace the arduous task of comparing prints stored on microfilm.
Until that time, possible matches were printed out on paper using the reference number of the 10-finger fingerprinting card. The corresponding fingerprint card was then retrieved on microfilm and compared with the traces from a crime scene by projecting the print onto a screen. After fingerprint processing increased strikingly in the field of asylum, the microfilm system was superseded by a time-saving image processor system with optical plates (Image Storage and Retrieval ISAR). This was to replace the arduous task of comparing prints stored on microfilm.

In 1988, the Printrak 300 system was updated to the Printrak 400 system. In order to store the fingerprint collection for the ISAR system electronically, the data were transported in stages back to the U.S.A. in strong wooden cases to a special centre that Printrak had set up for its clients for that purpose.

Also in 1988 the fingerprinting of asylum seekers became compulsory in Switzerland. This resulted in a further significant increase in the number of requests by the asylum authorities for fingerprint comparison. The AFIS Service was soon faced with a 6-month backlog of requests. Immediate action was taken, and it was decided to supplant the Printrak 400 system by the more powerful Orion system.
The collection of asylum seekers’ fingerprints was later sent to Printrak’s conversion centre in the U.S.A. for scanning. The increase in the number of asylum requests led to the establishment in 1990 of an independent identification service at the new Federal Office for Refugees, the successor office of the Office of the Delegate for Refugee Affairs. The same year, the Orion system was delivered and became operative.

With the introduction of AFIS, storing the original physical fingerprint cards under the Galton–Henry classification system became redundant, and the cards were filed in numerical order with the federal authorities.

The Orion system was upgraded in 1991. As the number of asylum requests continued to increase, intervention by politicians compelled the AFIS Service and Printrak to develop the Rapid Response AFIS (RRA), a combination of one-finger scans and fast-responding databases to enable the identification of people within a few minutes.

In 1992, the first live scanner for 10-finger printing was introduced in Europe. The devices were put into service in the reception centers of the Federal Office for Refugees, replacing the arduous process of taking fingerprints using ink.
The Rapid Response AFIS came into operation in Switzerland in 1995. It formed the basis for the modernization of the AFIS system and, in 1996, for the decision by various federal authorities to restructure both identification services.

Their merger into one identification service to be renamed “AFIS Services”, incorporated into the Data Processing Centre of the Federal Department of Justice and Police in 1997, brought the following improvements:

- Automatic search/comparison of all incoming fingerprinting cards (no more prior name checks necessary).
- Storage of all incoming fingerprinting cards (including multiple fingerprinting cards of the same person) instead of only those of the best quality.
- Introduction of the Process Control Number PCN, a national reference system (see Glossary).
- Outplacement of the Interpol identification service (now the International Identification Section, a unit of Fedpol’s International Police Cooperation Division).
- Reduction in identification time from hours and days to a few minutes only.

By 1998, the transition from fingerprint identification in the hands of an isolated group of a few specialists to a national process-oriented AFIS service was completed. Of the approximately 45,000 identification requests made to the AFIS Services in 1997, about 23,000 (51 percent) were submitted by the cantons, 20,000 (44.5 percent) were submitted by the Federal Office for Refugees and 2,000 (4.5 percent) were submitted by the Federal Office of Police.
The number of fingerprint matches to crime scene trace evidence increased thirtyfold over the pre-AFIS era.

The number of people identified by their fingerprints increased significantly after the identification services were restructured in 1996 and a new AFIS generation introduced. All fingerprinting cards have since been processed using AFIS. Before then, the authorities would check whether a person was registered in the police index using a name search. The significant increase in 1991 is a result of processing the backlog of identification requests from the asylum authorities.
In the year 2000, AFIS Services began operating 24 hours a day, facilitating round-the-clock real-time identification, and the service was incorporated back into the Federal Office of Police.

In 2002, the AFIS 2000 system was replaced by the Omnitrak system, also enabling the automated identification of palm prints. In addition, AFIS Services introduced, a message handler (an Internet-based communication platform), enabling positive negative database searches to be furnished with the data of the identified person and the results to be made directly available to the requesting party. At the same time, the Rapid Response AFIS was renamed “Identiscan”, and most police corps, the Border Guard Corps and numerous visa bureaus at Swiss embassies were linked up to the system, enabling a response to their identification requests within minutes.

In 2008, the Border Guard Corps and police forces introduced the one-finger mobile scanner (Mobile AFIS). The use of such devices has since continually increased.
In 2010, all 10-finger fingerprinting cards in the database were converted to high-resolution 1,000 ppi (pixels per inch), greatly enhancing the quality of the images. At the same time, the paper-based fingerprint data collection was destroyed. Since then, all fingerprints have been stored solely electronically.

On 7 November 2012, the French company Sagem Morpho was awarded the contract for delivery of a New Generation AFIS. The system is expected to be operational in 2013.
5.2 THE FUTURE – A NEW AFIS GENERATION

Press release by the Federal Department of Justice and Police of 22 December 2010

Bern. The Federal Council today approved the acquisition of a new automated fingerprint identification system (AFIS). The “New Generation AFIS” is an innovative instrument for capturing biometric and forensic data for use in identifying crime scene evidence and persons. The new solution will replace the existing system and is expected to come into operation in 2013.

The automated fingerprint identification system (AFIS) assists in the identification of persons and in the analysis of crime scene trace evidence by storing and comparing fingerprints and palmprints. The national AFIS database has been operated by the Federal Office of Police since 1984. Because of its proven quality and efficiency, it has become an integral part of today’s security needs. In 2009, approximately 128,000 checks on people were run on AFIS, resulting in 52,000 hits. A further 2300 people – primarily offenders – were identified by analyzing and comparing finger and palm prints recovered from crime scenes.

New system urgently required

Since AFIS was last updated in 2002, the volume of identification requests has increased strikingly and the existing system has reached its technical limitations. Continuing with the present system could lead to a nationwide breakdown in the fingerprint identification system. This would mean that the Federal Office of Police could no longer fulfill its service mandate from partners such as the cantonal police, the Border Guard Corps, the Federal Office for Migration, Swiss embassies and Interpol, which need 24 hours, all year round access to the system.

Besides technical factors, international requirements need considering: Switzerland exchanges data via Eurodac, the European fingerprint database for identifying asylum seekers, and via Interpol. To ensure continuing compliance with technical and quality requirements, the current AFIS must be replaced with a New AFIS Generation. The cost of the new system – approximately 18.5 million Swiss francs – is to be borne by the Confederation.
Clear statutory provisions

The use of AFIS for finger and palm print identification is subject to strict statutory provisions, especially Article 354 sections 1 and 4 of the Swiss Criminal Code (SCC; SR 311.0) and Article 102 section 2 of the Foreign Nationals Act (FNA; SR 142.20). Further details have been regulated by the Federal Council in various implementing provisions. The Ordinance of 21 November 2001 on the Processing of Biometric Data (SR 361.3), for example, limits the definition of biometric data to finger and palm prints, crime scene trace evidence, photographs and personal descriptions, and regulates the use of AFIS. The statutory provisions on international data exchange via Eurodac are contained in Articles 102a to 102e of the Asylum Act (AsylA, SR 142.31) and those pertaining to Interpol in Articles 350 to 352 SCC.
6.1 Basics

The following basic facts apply in fingerprint identification:

- The human fingerprint is unique to a person.
- The human fingerprint does not change with time.

Whenever we touch an object with our hands or fingers, we leave a distinct impression on the surface of that object, similar to an ink print a print stamp leaves on a piece of paper. Mostly, fingerprints are not visible to the naked eye, but must be made visible for use in identification. Dusting such poorly visible fingerprints with aluminum powder is among the oldest, yet still most widespread methods. Applied to a fingerprint, the powder sticks to the sweat and sebaceous particles left on the surface and renders the print visible. An adhesive foil, such as a gelatin fingerprint lifter - sometimes referred to as a Vienna lifter (see chapter 10.8) - is used to lift the print from the surface. Thus secured, the print can be photographed.

Using this method irrefutably links a print secured from an object to the person who touched that object. Fingerprinting can also establish connections between criminal offenses.

6.2 Levels of Comparison

Fingerprint examiners distinguish between three levels of fingerprint identification, working down from the most general characteristics in a print to the most specific ones.
Ebene 1
Level 1 details – general overall pattern shapes – are discernible by the naked eye.

Ebene 2
It takes a magnifying glass to examine level 2 details, the basic ridge characteristics or minutiae.

Level 3 details
Level 3 details become clearly visible only when examined with a microscope. The microscope reveals the number and location of pores and the ridge shape.

Today’s state-of-the art computer systems designed for fingerprint analysis allow infinitely variable and detailed three-level examination in high resolution images, making magnifying glasses and microscopes redundant.
6.3 THE IDENTIFICATION PROCESS

The identification process consists in examining the comparison area from an impression left by a finger or the ball of a thumb. Examiners follow an internationally standardized sequential process, the ACE-V process (Analysis, Comparison, Evaluation, and Verification).

**Analysis**
All level 1 through level 3 characteristics are examined for qualitative and quantitative differences and similarities.

**Comparison**
Similarities and differences found in the examined print are compared with a reference print.
Evaluation
The aim of the comparison is to draw one of the following conclusions:

- The prints are identical and were therefore made by the same person.
- The prints are not identical and were therefore not made by the same person.
- It cannot be excluded that the person XY has left the crime scene evidence in question.

Verification
The final process is verification. All identifications must be verified by a second expert in an independent examination of the fingerprints. The findings of the first examiner become official only if the verifying examiner confirms them.
Using biometric data in passports is nothing new. Passports have always contained some biometric data, such as a picture, and the height and signature of the holder. At the beginning of World War I, all European states declared passports compulsory for travel abroad. At that time, Swiss citizens traveled on passports issued by the cantons. These passports differed from each other in form and content. Soon after uniform national passports became compulsory, Swiss citizens traveling abroad began complaining that their cantonal passports were often not recognized as valid documents and hence their holder was not acknowledged to be a Swiss citizen. Compelled to follow the practice of other countries, the Swiss government issued a state of emergency decree in 1915 that the cantonal passports be replaced by a uniform national passport. The delegates to the second ordinary conference of the International Criminal Police Commission (ICPC) in Vienna in 1926—the ICPC is the forerunner of Interpol—decided that fingerprints be included in passports (cf. letter of 19 January 1927 by the chief of police of Gdańsk; chapter 10.5.). For political considerations, however, Switzerland decided in 1928 against prescribing the use of fingerprints in passports, at least for the time being.

With the aim of speeding up border checks and making border control more effective, the international community began addressing the topic of electronic passports as early as the 1990s. The terrorist attacks of 11 September 2001 on the World Trade Center in New York City eventually ushered in the introduction of electronic passports. The United States was the driving force behind the idea and instrumental in establishing the biometric passport internationally.

Since 2006, Swiss passports have contained, besides the personal data of the holder, a computer chip with the holder’s digital image that corresponds to the personal photo in the passport.
In 2008, a non-party committee submitted 63,733 signatures to the Swiss Federal Chancellery calling for a referendum on the proposed introduction of the biometric passport. In particular, the petitioners opposed a centralized biometric database and the decision to discontinue, after a two-year transition period, the issuance of identity cards by the communes. In the popular vote in 2009, the electorate voted by a small margin of 50.14 percent, or 5,504 votes, in favor of the biometric passport.

A treaty between Switzerland and the European Union provided that passports issued from 1 March 2010 had to contain two fingerprints. Switzerland met this requirement, introducing the Swiss passport '10 series on time. To produce the new passport, 37 cantonal passport centers and over 120 Swiss diplomatic representations abroad were equipped with the necessary technical infrastructure for recording the biometric data, and over 600 people were trained. Six months after the Swiss passport had been introduced, over a quarter of a million Swiss citizens were in possession of a new biometric passport. It did not take long for the possibility of ordering the new passport online via www.schweizerpass.ch to catch on.

Schengen legislation has been further developed, and Switzerland has been required since 24 January 2011 to also provide biometric residence permits for third-state members. Since that date, type B, C, and L residence permits for foreign nationals have contained a chip with a digital image of the holder’s face and two fingerprints of the holder. All data of the biometric permits issued to foreign nationals are managed by the Central Migration Information System (ZEMIS), run by the Federal Office for Migration. These data are protected against unauthorized access.

Data on Swiss citizens’ passports and identity cards are stored in separate databases that are highly protected from unauthorized access. These databases are run by the Identity Documents and Missing Person Investigations Section, a unit of the Federal Office of Police.
“Working as executive assistant at the Extradition Section in the second half of the 1970s, I often had the great opportunity of cooperating with fingerprint experts from the Identification Service. Almost all of them were clad in white doctor’s robes. They were ever so helpful to me whenever I had a question. They even crash-coursed me on bits of fingerprinting and international wanted person search. I soon learned that fingerprints serve as crucial evidence in court. What is more, I had always been most impressed by these colleagues’ expertise and the accuracy with which they worked. At that time, the United States was the leading force in further developing methods of electronic fingerprint analysis and evaluation. In the early 1980s, my predecessor managed to raise the funds necessary to purchase an automated fingerprint identification system, or AFIS, from a U.S. company. If my memory serves my right, the initial purchase cost over ten million Swiss francs. Luckily, this acquisition soon proved to be worthwhile, because thanks to AFIS, the number of hits, that is, positive identifications of people by means of comparing fingerprints, began to rise at an impressive rate. Perhaps, what thrilled me even more was the fact that with all the technical achievements, the fingerprint experts’ know-how remained an essential tool for analyzing and evaluating each hit. Heading the Swiss Central Police Bureau from 1988, I saw AFIS grow steadily. I also played a part in making AFIS available for use in asylum matters and later expanding the system for use in DNA data storage. Until the early 1990s, the Identification Service was a section of the Swiss Central Police Bureau. This bureau, in turn, was a main division of the Attorney General’s Office to which the Central Criminal Records Registry, the Interpol Unit Switzerland, and the Central Offices of Criminal Police were attached. This section later became the Federal Criminal Police. As long as human beings commit crimes – particularly offenses against life and limb or property offenses – the use of hands is involved, and more often than not fingerprints are left behind at a crime scene. To be sure, there are other kinds of crime scene evidence.
And the more sophisticated the means for electronically storing and analyzing such evidence become, the more important such evidence will be in court; however, fingerprinting will for quite some time remain one of the most essential methods of identifying and convicting perpetrators of a crime or clearing them from charges. New methods of electronic fingerprint analysis and evaluation will no doubt further improve the quality of fingerprint evidence too. But one thing we know for certain: with all the state-of-the-art technology we have, the fingerprint expert cannot be dispensed with; rather, these fine people are all the more indispensable, for they are the ones to use and operate the new technology. These people have always kept abreast of changing times and new challenges, just as they did when AFIS was first introduced and they stopped wearing their white doctor’s robes.”

Roland Gander, Head of AFIS Services from 1996 to 2004. AFIS Specialist Since 2004

“Introducing the Automated Fingerprint Identification System (AFIS) in 1984 meant a decisive improvement in fingerprinting analysis and evaluation in Switzerland. The federal administration funded AFIS and offered the cantonal law enforcement free use of the services of this system. These facts have contributed to Switzerland’s taking a leading role in processing and analyzing fingerprints for many decades. Fingerprint analysis has long been a male domain in this country; however, since the establishment of the AIFS Services in 1996, women have joined the AIFS Services and become expert partners in processing and analyzing fingerprint evidence. Switzerland is one of the few countries that have constantly reorganized the entire AIFS infrastructure, thus enabling the AFIS Services to provide efficient services that have remained unparalleled to this day. By introducing a method for analyzing and evaluating palmprints in 2002, the arsenal of tools for identifying people became complete. A total of 440 people were trained in German, French, and English in using this new method. Thanks to the high Swiss standards applied in securing, analyzing, and evaluating finger- and palmprints, recurrent criticism of the conclusiveness and probatory value of fingerprinting could largely be forestalled. To keep abreast of the latest in fingerprint analysis technology, the current AFIS will be supplanted by a completely new system in 2013, thus ensuring a continuously high standard of service. Long-lasting repercussions of the current financial crisis and cutbacks in spending will only contribute to raising people’s awareness of how efficient and economic a method fingerprinting is for crime solving. Therefore, it is safe to say that fingerprinting will stay with us for quite some more time.”
“I have been in fingerprinting since 1976. Back then I was an IT analyst and involved in a large-scale project developing an information system for sharing criminal data between federal and cantonal prosecuting authorities. We had an unexpected visit from a representative of a U.S. corporation, Rockwell Autonetics Group. He presented the System Printrak 250 to us, a fingerprint identification solution that aroused our interest. My job involved process analysis. This analysis work touched upon operations spanning all four sections of the Swiss Central Police Bureau (Identification Service, Central Offices of Criminal Police, the Interpol unit Switzerland, and the Central Criminal Records Registry). Printrak offered potential to make combatting crime in Switzerland more effective, at least in the medium term. We started working at an automated fingerprint identification system (AFIS), going at it hammer and tongs. What began as a bright idea developed into a comprehensive system integrating technical and human resources. AFIS became operational in 1984. Within a short while, it surpassed all our expectations. Efficiency and the success rate increased tenfold. I later became charged with other tasks but had the great opportunity of assisting in further developing AFIS as head of the Computer Centre Division and as IT police coordinator with the Federal Department of Justice and Police. Automated fingerprint identification has greatly changed since AFIS was first introduced, and more change is underway. AFIS is expected to be updated with new functions every five to six years. These updates are a challenge to all users of AFIS who want to make the most of this system. My best wishes go to the folks at the AFIS DNA Services. As our American colleagues used to say, “Hit’s is the name of the game!”

DENIS ChALLET, IDENTIFICATION SERVICE OFFICER, LATER AFIS SPECIALIST FROM 1983 TO 2008

“I began working at the Swiss Central Police Bureau as fingerprint specialist in 1983. At that time, the Galton–Henry classification was still in use, and I had to learn to work with it. From 1984 we began transferring data from fingerprint cards to an automated fingerprint identification system, AFIS. The data on the cards were to be stored according to the NCIC standard of the FBI (National Crime Information Center). Many helping hands form the cantonal identification services assisted in completing this task. Once again, I was facing another challenge – learning to cope with new technology and to operate AFIS, the new automated fingerprint identification system. This system has ever since been continuously developed and upgraded.
Thanks to AFIS, searching for matching fingerprints has become more and more efficient and much faster than we could have thought possible. If it were not for IT technology, it would be impossible in today’s fast-paced world to efficiently and effectively identify people and analyze crime scene evidence.”

PIERRE MOUCHE,
IDENTIFICATION SERVICE OFFICER, LATER AFIS SPECIALIST
FROM 1974 TO 2004

“I’m 69 years old now. The science of fingerprints has always fascinated me. I began working at the Identification Service of the Bern cantonal police in 1970. At that time, fingerprint characteristics were converted into a recordable algebraic formula according to a method designed by Juan Vucetich. In 1974, I took up a position at the Swiss Central Police Bureau, headquartered on Wildstrasse No. 3 in Bern. There were ten of us. All were former police officers. Two years later, the bureau was moved to a new address on Bundesrain No. 20 in Bern. The Identification Service then used the Galton-Henry method for classifying fingerprints in general and those secured at crime scenes in particular. We worked with the help of fingerprint cards. These cards were filed manually in filing cabinets. In 1984, an automated fingerprint identification system (AFIS) was introduced, allowing processing an impressively high number of latent fingerprint traces. Some ten years later, our service has begun to also operate a DNA database. Today, this service employs twenty-five people, but not all of them have a police training background. After more than thirty years with the police, it was time for me to go into well-deserved retirement.”

MARKUS HESS,
FORMER HEAD OF AFIS MAINTENANCE (ASCOM), CURRENTLY HEAD
OF THE SPECIAL SECTION FOR STRATEGY / PLANNING IDENTIFI-
CATION WITH THE FEDERAL OFFICE OF POLICE

“Faster, better, and cheaper – these requirements were valid yesterday, and they are still valid today; however, new requirements have been imposed on us over the past years: data exchange must be highly networked, safe, comprehensible, and flexible. The first country in Europe to work with AFIS, Switzerland has always been at the forefront of developing AFIS technology and the necessary infrastructure. Now, the latest AFIS generation has arrived. And we have reason to be proud, as we have added another chapter to AFIS history in Switzerland. In fact, we have an essential part in contributing to security in this country. Ultimately, however, what seems most important to me is that with all the development in AFIS technology since the 1980s, the passion for fighting crime has remained unchanged.”
THE MANY FACES OF FINGERPRINTS

SAMPLES FROM THE COLLECTION OF AFIS DNA SERVICES' SPECIALIST, KILIAN STUDER:
Kreisschreiben
des
Bundesrates an sämtliche Kantonsregierungen betreffend
Zentralstrafenregister und schweizer. Polizeianzeiger.

(Vom 21. November 1905.)

Gebreue, liebe Eidgenossen!


Am 10. Oktober abhin befaßte sich die in Bellinzona zusammengetretenen VI. Konferenz der kantonalen Polizeikommandanten des nähern mit der neuen Institution.

Während die anthropométrische Zentralregistrierung und der damit zusammenhängende Nachrichtendienst zu keinen Bemerkungen Anlaß gab, gelangten in bezug auf das Strafenregister und den Polizeianzeiger verschiedene Wünsche zum Ausdruck, die wir Ihnen hiermit zur Kenntnis bringen.

1905 — 500


**Luzern.**

Der Stand der Dactyloskope in der Schweiz am 30. Juni 1911.


In dieser Erwartung ist es ohne Interesse, sich über den gegenwärtigen Stand der Dactyloskopie in der Schweiz ein richtiges Bild zu machen, d. h. zu sehen, was bei uns auf dem Gebiete der Dactyloskopie bereits erreicht ist, was für Erfahrungen gemacht und was für Resultate erzielt wurden. Zu diesem Zwecke wurde von Sachleuten diese älteren Berichte Polizeichefs der Kantonezugrucht der folgende Fragen entlehnt:

1. Haben Sie in Ihrem Kanton eine dactyloskopische Registerstelle, eventuell seit wann?
2. Wie viele Karten enthält Ihre Sammlung am 30. Juni 1911?
3. Welches Registerbuch wird angewendet?
4. Was wäre ohne die Streitbeantwortung?
5. Was sind die aktiven Karten bei der Anzahl eines Exemplares ausgebogen (für Männer und Frauen) wird hinzugerechnet.
6. Wie werden die Karten aufbewahrt?
7. Wie viele Identifikationen konnten bis zum 30. Juni 1911 auf Hilfe der Dactyloskope bestätigt werden?
8. Was für einen weiteren praktischen Wert oder Nutzen haben Sie in der Identifikationsverfahren gefunden?
9. Waren von Personen, die nicht anthropometrisch genommen wurden, Fingerabdrücke genommen; eventuell was für eine Kategorie Personen betreibt dies, oder wird nur dactyloskopiert, wer auch anthropometrisiert wird?
10. Welcher Zusammenhang existiert zwischen Ihrer anthropometrischen und Ihrer dactyloskopischen Sammlung (Ausgabe auf Karten im alphabetischen Register etc.)?
11. Erzählen Sie die Erstellung einer dactyloskopischen Zentralregister für das ganze Schwyzer (wie für die Anthropometrie) als wünschenswert erachtet?
12. Sollten auch Ihren Dactylo-Vorläufer Bezirksämter oder Landesamt-Unterabteilungen erreicht werden, Fingerabdrücke aufnehmen?
13. Was sagen Sie zu der in der Zeitung vorgeschlagenen Methode Dass?
14. Waren haben Sie eine dactyloskopische Registerstelle eingeschaltet, und wie können Sie dazu, die Dactyloskope bei Ihnen einrichten?

Dank der Zuvorkommmendheit der genannten Herren, die sich die Mühe nicht nehmen lassen, die Fragebogen sehr ausführlich zu beantworten, ist es heute möglich, sich über die Anwendung der Dactyloskopie in der Schweiz umfassendste zu erkennen.

Von drei Kantonen haben zwischenzeitlich ihre dactyloskopischen Registerstelle, und zwar drei nicht die Methode Henry, mit einer Gesellschaft von ca. 8000 Karten. Es sind dies die Kant-

Zwei andere Kantone haben Nämlich von Fingerabdrucks- legen angelegt, die jedoch noch nicht doktylographisch registriert.


Von der geringen Anzahl doktylographisch registrierter Fingerabdruck legen konnte in Luzern in halben Jahr ca. 500 und in Aarau seit 1908 ca. 40 Identifikationen vorgenommen werden. In Basel, wo die Fingerabdruckkarten nur in alphabetischer Reihefolge registriert sind, bestand gleichwohl schon mehr als 100 Identifikationen erreicht.

Tabellarisch zusammenge stellt ergibt sich das hierer genannte wie folgt:

<table>
<thead>
<tr>
<th>Kanton</th>
<th>Datum der Einführung</th>
<th>Anzahl der Karten</th>
<th>Methode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zürich</td>
<td>1896</td>
<td>ca. 800</td>
<td>Henry</td>
</tr>
<tr>
<td>Bern</td>
<td>1908</td>
<td>ca. 2960</td>
<td>Henry</td>
</tr>
<tr>
<td>Luzern</td>
<td>1908</td>
<td>ca. 6000</td>
<td>Henry</td>
</tr>
<tr>
<td>Basel-Stadt</td>
<td>1904</td>
<td>5157</td>
<td>Henry</td>
</tr>
<tr>
<td>Thurgau</td>
<td>1909</td>
<td>7</td>
<td>Henry</td>
</tr>
<tr>
<td>Aarau</td>
<td>1910</td>
<td>2000</td>
<td>Henry</td>
</tr>
</tbody>
</table>

Die Anzahl der Fingerabdruckkarten hat die Beschäftigung, d. h. das Verantwortung und die Einrichtung der Fingerabdruckkarten.

Die Karten, welche definitive Identifikationen angeben haben, sind der Henry'schen Registerungswirkung verpflichtet. In der Henry'schen Fingerabdruckkarte in Anwendbarkeit, genannt, sind die Henry'schen Fingerabdruckkarten. Diese sind auf der Basis der Fingerabdruckkarte für Vor- und Familienname, für die Klassenbezeichnung, für die zugeordnete Fingerabdruckkarte, für den Gleichzeitig-Abschnitt von der Fingerabdruckkarte und der rechten Hand für die Untersuchung des Individuums, für die Aufnahme gemacht der, die Aufnahme der Aufnahme, sowie für eventuelle Anmerkungen. Auf allen Karten ist auf der Rechtecke Raum für die Unterschrift des Doktylographen, für den Personen, für die Aufnahme einer anthroponeumatischen Photographie, für die anthroponeumatische Masse und beim äußeren besonderen Konstruktions.


Kreisschreiben an die Polizeidirektionen der Kantone.

Herr Regierungsrat,

Nachdem im Interesse des politischen Erkennungsdienstes von zahlreichen ausländischen und einzigen kantonalen Polizeiverwaltungen neben den anthropometrischen auch Dactyloskopische d.h. Fingerabdrucksregistrierungen eingeführt worden sind, ist uns von verschiedenen Kantone, namentlich gelegentlich, erwähnt worden, dass einige Kantone sich von unseren Zentralpolizeibüros eine entsprechende Registrierung eingerichtet haben.

Wir haben dies gut und beachten uns, die neu eingerichteten Register in den kantonalen Polizeibehörden zur Verfugung zu stellen. Die Fingerabdruckkarten sind in gleicher Weise wie die anthropometrischen Signalemente zur Klassifizierung der Zentralpolizeibüros einzusenden.

Das aufgestellte Formular, von dem wir zwei deutsche und zwei französische Exemplare beilagen, ist auf der Rückseite auch für die Eintragung des anthropometrischen Signalements eingerichtet; die Eintragung des letzteren ist jedoch nicht verpflichtend. Das neue Formular wird vom Zentralpolizeibureau zum Selbstkostenpreise abgegeben, nämlich 100 Stück zu Fr. 2.–.

Es darf bemerkt werden, dass, wenn auch die Abnahmen der Fingerabdrücke keine besonderen Schwierigkeiten bietet, dieselbe doch, um ein brauchbares Bild zu erhalten, nach bestimmten Regeln vorgenommen werden muss. Sollte sich unter Ihren Beamten keiner befinden, der damit vertraut ist, so dürfte es sich empfehlen, einen derorts zu beauftragen, die erforderliche Fertigkeit bei einem kantonalen Polizeikommando zu erlangen, das die Dactyloskopie bereits eingesetzt hat (Zürich, Basel und Basel).
Für den Fall, dass Sie in Ihrem Kanton eine eigene daktyloskopische Registriatur einführen oder die bereits vorhandene weiterführen wollen, wären die Aufnahmen jeweils doppelt anzufertigen. Sollte sich eine kantonale Polizeiverwaltung entschliessen, ihre Sammlung von Fingerabdruckkarten neben derjenigen des Zentralpolizeibureaus nicht länger bestehen zu lassen, so möge das vorhandene Material diesem gerl. zur Klassifizierung eingesandt werden.

Die Daktyloskopie ist momentan anzuwenden, wo es sich um Nachforschungen handelt, die bei ausländischen Behörden vorgenommen werden sollen, die nur eine daktyloskopische Registriatur besitzen, wie London und New-York, und ferner bei solchen Personen, die aus irgendeinem Grunde nicht messen will, z.B. wegen der Geringfügigkeit des Falles oder wegen der grossen Entfernung von kantonalen anthropometrischen Bureaus.

In allen wichtigeren Fällen und special dann für die Nachforschungen die grosse anthropometrische Kartenzentrale der Polizeipräfektur von Paris in Anspruch genommen werden soll, oder wenn es sich darum handelt, ein genaues Signalament aufzunehmen, empfiehlt es sich, auch fernhin das anthropometrische System nach Bertillon zu benutzen.

Allfällige weitere Ausführungen über diesen Gegenstand wird unser Zentralpolizeibureau gerne erteilen.

Mit ausgesprochener Hochachtung.

Bern, den 15. Dezember 1912.

Schweizerisches
Justiz- & Polizei-Departement

Stellagen erwähnt.

[Unterschrift]
10.5 LETTER FROM THE POLICE PRESIDENT OF THE FREE CITY OF GDANSK FROM 1927

Danzig, den 29. Januar 1927

An das Schweiz. Zentralbüro
Erkennungsdiensst
in Bern.

Betr. Verwendung des Reisepasses als Identitätsdokument.


Ich gestatte mir ergebenst die Anfrage, ob dortseits beabsichtigt ist, die Einführung des Fingerabdrucks für Reisepässe vorzubereiten bzw. in welchem Umfange bereits der Fingerabdruck Aufnahme in Personalausweisen gefunden hat. Für eine baldige Mitteilung, gegebenenfalls unter Beifügung von Abschriften erlassener Bestimmungen, wäre ich besonders dankbar.

Gedenken Sie, Herr Präsident, den Ausdruck meiner vorgesicherten Hochachtung

[Unterschrift]
Erster Staatsanwalt.
10.6 LETTER BY J.E. HOOVER, FOUNDER OF THE FBI, TO FRIEDRICH BORN, HEAD OF THE IDENTIFICATION SERVICE

November 1931

Mr. Friedrich Born,
Chief Identification Officer,
Fingerprint Section,
Berne, Switzerland.

Dear Mr. Born:

From time to time I have corresponded with the Identification Bureaus of the more representative countries throughout the world to request information regarding the methods of criminology and identification used in the said countries, and also to obtain information regarding the number of fingerprints appearing in the various collections maintained for the purpose of identifying criminals and persons charged with crimes.

In November of 1929 I prepared an article for the Annals of the American Academy of Political and Social Science regarding the subject of criminal identification, and am attaching a copy of the same for your information, and file.

I would appreciate receiving information from you regarding the latest methods of criminology and identification work in your country, with advice concerning the number of fingerprints in your files, in order that the same may be available for reference in this Bureau should there be need therefor in the future.

With expressions of my appreciation for your courtesy and assistance in this matter, and assuring you of my desire to reciprocate as occasion may permit, I am

Sincerely yours,

J. Edgar Hoover
Director.

Incl. #611511.
Cher Monsieur,

J'écris en ce moment dans le tome IV du Traité de Criminalistique le chapitre relatif à la description des fiches d'identité en tous pays. Vous me rendriez très grand service en ayant la complaisance de m'envoyer la collection des modèles de fiches (décadactylique, monodactylique, etc) employées actuellement en Suisse.

Vous savez, je pense, que j'ai décrit avec détail votre excellente méthode monodactylique dans le tome Ier du Traité.

Avec tous mes remerciements, et mes vœux de bonne année, je vous prie d'agréer, cher Monsieur, l'expression de mes sentiments bien dévoués.

Ed. Locard

An das
Schweiz. Zentralpolizeibureau
Erkennungsdienst
Bern.

Sehr geehrter Herr Born,


Da ich nun keine Möglichkeit mehr sehe, wie ich das
Material beschaffen könnte, gelange ich mit der Bitte um Rat an Sie. Wäre es event. möglich durch Vermittlung des Poli Departe-
mentes in Bern bei der Besatzungsbehörde das Ersuchen um Abgabe
der von uns benötigten schwarzen Folien zu stellen?
Ich glaube, dass sich andere Kantone event. gerne an
einer Bestellung beteiligen, was eine Rundfrage bei den verschie-
denen Erkennungsdiensten zeigen würde. Auch habe ich den Eindruck
erhalten während den Verhandlungen mit dem brit. Konsulat, dass
ein gesamthaft schweizerisches Gesuch mehr Erfolg hätte, als ein
Einselnes eines Kantons.
Wir würden uns an einer Bestellung mit 50 Mäppchen
(1 Mäppchen von Schneider enthielt 6 Folienblätter, Grösse 11x18 cm)
event. sogar mit 75 Mäppchen beteiligen. Natürlich würden Speisen
für Transport und Zoll etc. wie bis anhin gerne bezahlt.
Ich wäre Ihnen, sehr geehrter Herr Born, sehr dankbar,
wen Sie mir über diese Schwierigkeit hinweghelfen könnten. Mit
den besten Wünschen für Ihre Gesundheit und dem Ausdruck vollkom-
mener Hochachtung verbleibe ich

Ihr

[Unterschrift]

X. Wintsch

9. Aug. 1945
### GLOSSARY

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>ACE-V</td>
<td>The acronym for the sequential process followed by friction ridge examiners in performing a visual comparison and arriving at a conclusion: Analysis, Comparison, Evaluation, Verification. (See individual terms).</td>
</tr>
<tr>
<td>Analysis (ACE-V)</td>
<td>The unknown item must be reduced to a matter of properties or characteristics. These properties may be directly observable, measurable, or otherwise perceptible qualities.</td>
</tr>
<tr>
<td>AFIS</td>
<td>Automated Fingerprint Identification System. A general term for a computerized friction ridge storage and retrieval system. AFIS computers were initially for fingerprints only but later added palmprint storage and search capabilities.</td>
</tr>
<tr>
<td>Anthropometry</td>
<td>The scientific study of the measurements and proportions of the human body.</td>
</tr>
<tr>
<td>Biometry</td>
<td>The statistical study of biological data.</td>
</tr>
<tr>
<td>Comparison (ACE-V)</td>
<td>The properties or characteristics of the unknown are now compared with the familiar or recorded properties of known items.</td>
</tr>
<tr>
<td>Dermis</td>
<td>The layer of skin beneath the epidermis.</td>
</tr>
<tr>
<td>DNA</td>
<td>Deoxyribonucleic acid (DNA) is a molecule encoding the genetic instructions used in the development and functioning of all known living organisms and many viruses.</td>
</tr>
<tr>
<td>Eccrine gland</td>
<td>Sweat glands that open on all surfaces of the skin.</td>
</tr>
<tr>
<td>Epidermis</td>
<td>The outer layer of the skin.</td>
</tr>
<tr>
<td>Epidermal ridges</td>
<td>Ridges on the skin of the hands and feet, aka friction ridges and papillary ridges. They are the root system of the surface ridges and furrows, where tactile receptors are situated.</td>
</tr>
<tr>
<td>Evaluation (ACE-V)</td>
<td>It is not sufficient that the comparison disclose similarities or dissimilarities in properties or characteristics. Each characteristic will have a certain value for identification purposes, determined by its frequency of occurrence. The weight or significance of each must therefore be considered.</td>
</tr>
<tr>
<td>FBI</td>
<td>Federal Bureau of Investigation. A governmental agency belonging to the United States Department of Justice that serves as both a federal criminal investigative body and an internal intelligence agency (counterintelligence).</td>
</tr>
<tr>
<td>Forensics</td>
<td>(Short for forensic science); application of a broad spectrum of sciences and technologies to investigate and establish facts of interest in relation to criminal or civil law. The term forensics comes from the Latin forensis, meaning “of or before the forum.” In Roman times, a criminal charge meant presenting the case before a group of public people in the forum.</td>
</tr>
<tr>
<td>Friction ridge</td>
<td>A raised portion of skin found on the skin of the hands and of the feet, consisting of one or more connected ridge units.</td>
</tr>
<tr>
<td>Furrows</td>
<td>Valleys or depressions between friction ridges.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------------</td>
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</tr>
<tr>
<td><strong>Minutiae</strong></td>
<td>Small details; characteristic events along the course of a single friction ridge, including ending ridges, bifurcations, and dots. Friction ridge patterns and minutiae configuration are unique to a person.</td>
</tr>
<tr>
<td><strong>Papillae</strong></td>
<td>A small peg-like protuberance or elevation of the dermis.</td>
</tr>
<tr>
<td><strong>Papillary layer</strong></td>
<td>The superficial layer of the dermis raised into papillae that fit into corresponding depressions on the inner surface of the epidermis.</td>
</tr>
<tr>
<td><strong>Papillary ridges</strong></td>
<td>Orderly rows of eccrine glands positioned along the path of the friction ridge.</td>
</tr>
<tr>
<td><strong>Pattern type</strong></td>
<td>Fundamental pattern of the ridge flow: arch, loop, and whorl. Arches are subdivided into plain and tented arches; loops are subdivided into radial and ulnar loops; whorls are subdivided into plain whorls, double loops, pocket loops, and accidental whorls.</td>
</tr>
<tr>
<td><strong>PCN</strong></td>
<td>Process Control Number; an encoded 10- or 12-digit confirmation/tracking number assigned each time a person has been fingerprinted. This number refers to DNA or fingerprint data and indicates who the owner of the data is and what the data are about (trace, person). Using a 2-digit control number, it is possible to identify mistyped digits.</td>
</tr>
<tr>
<td><strong>Pores</strong></td>
<td>Small openings on friction ridges through which body fluids are released.</td>
</tr>
<tr>
<td><strong>Poroscopy</strong></td>
<td>The study of the pores. In fingerprint identification, the number and shape of pores found on friction ridges used for comparing crime scene evidence (fingerprint and the balls of thumb) with a reference print. Poroscopy was established by Dr. Edmond Locard of Lyon, France in 1912.</td>
</tr>
<tr>
<td><strong>Primary ridges</strong></td>
<td>Ridges on the bottom of the epidermis under the surface friction ridges; the root system of the surface ridges (also termed epidermal ridges).</td>
</tr>
<tr>
<td><strong>Ridged skin</strong></td>
<td>Parallel grooves on the skin of the palms of the hands and soles of the feet.</td>
</tr>
<tr>
<td><strong>Secondary ridges</strong></td>
<td>Ridges on the bottom of the epidermis under the surface furrows.</td>
</tr>
<tr>
<td><strong>Verification (ACE-V)</strong></td>
<td>The final step of the ACE-V method. A review and independent analysis of the conclusion of another examiner.</td>
</tr>
</tbody>
</table>


Champod C., Margot P., 1996, Université de Lausanne, L’identification dactyloscopique, Institut de Police Scientifique et de Criminologie.


Heindl Robert, 1921, Berlin und Leipzig, VWV, System und Praxis der Daktyloskopie.

http://theartinquirer.blogspot.ch/2011/08/100-years-ago-vincenzo-peruggia.html

Locard Edmond, Directeur du Laboratoire de Police de Lyon 1910–1951, Mémoires Originaux/La preuve judiciaire par les empreintes digitales.

Loertscher Walter, 1991, Lausanne, Imprimeries Réunies Lausanne s.a., Die Kantonspolizeien der Schweiz.


Schwager Nicole, 2006, Zürich, Chronos, Der Fingerabdruck als kriminalisierendes Zeichen.

Schweizerisches Bundesarchiv, Bern.


Whipple Inez L., 1904, Stuttgart, The Ventral Surface of the Mammalian Chiridium with special reference to the conditions found in man.

Wikipedia - the free encyclopedia.


Fundamental ridge pattern types; Federal Office of Police fedpol, AFIS DNA Services

Core and delta in a fingerprint; Forensisches Institut Zürich


Breaking offenders on the wheel was a common method of execution; Das Räder des Hans Spiess, Diebold Schilling Chronik 1513, copyright Eigenrum Korporation Luzern


Illustration from a Swiss wanted persons record; Martin Urs Peter


Photos and fingerprints of two different people; System und Praxis der Daktyloskopie, p. 447, Dr. R. Heindl, Vereinigung Wissenschaftlicher Verleger, 1922

Photos and fingerprints of the same person; System und Praxis der Daktyloskopie, p. 448, Dr. R. Heindl, Vereinigung Wissenschaftlicher Verleger, 1922


Employee of the Royal Canadian Mounted Police (RCMP) searching a fingerprint register sorted according to the Galton–Henry system; Royal Canadian Mounted Police, Canada


[33] The "Bertillon non-match." Image of the fingerprint impressions of two distinct persons, showing 16 similar ridge features; [34] http://www.henrytempleman.com/bertillon_non-match
[41] Dr. Edmond Locard (front), 1877–1966; [42] Locard’s influence, Prof. Pierre Margot, presentation at the meeting of the ENFSI Fingerprint Working Group, Lyon, 2012
[47] Employee at the Royal Canadian Mounted Police searching a fingerprint register; [48] Royal Canadian Mounted Police, Canada
[49] In an AFIS query, details such as the position and the direction of bifurcations and ridge endings and their mutual relation are analyzed and evaluated; Federal Office of Police fedpol, AFIS DNA Services
[50] One of the first AFIS computer systems operating with videotapes for storing fingerprints; Royal Canadian Mounted Police, Canada
[51] Part of an advertisement for Rockwell's fingerprint identification system; Martin Urs Peter
[52] The Swiss Central Police Bureau at Wildstrasse No. 3 in Bern; Federal Archives
[55] Premises of the Police Records Department at Wildstrasse No. 3 in Bern; Federal Office of Police fedpol, AFIS DNA Services
[56] Specimen of a single-fingerprint card; Martin Urs Peter
[57] Friedrich Born, head of the Identification Service (1937); Federal Office of Police fedpol, AFIS DNA Services
[58] Office at Wildstrasse No. 3 (1937) — Fingerprint records filed according to the Galton-Henry system; Federal Office of Police fedpol, AFIS DNA Services
[59] Specimen of a ten-fingerprint card, with a Galton-Henry classification formula in the upper right-hand corner; Federal Office of Police fedpol, AFIS DNA Services
[60] Defunct crime scene evidence hangfiles with tabs, arranged according to offenses; Martin Urs Peter
[61] Entrance to the federal administration building on Bundesrain No. 20, Bern; Federal Office of Police fedpol, AFIS DNA Services
[62] Pierre Mouche, a fingerprint examiner with the Identification Service, comparing crime scene fingerprints against a ten-fingerprint card in the early 1980s; Martin Urs Peter
[63] System DLRPrintrak 300; Martin Urs Peter
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[62] Mobile one-finger scanner; Federal Office of Police fedpol, AFIS DNA Services
[64] Twirling a brush to apply aluminum powder for fingerprint recovery; www.istockphoto.com
[65] Various dermal ridge patterns; Forensic Institute Zurich
[66] Image showing characteristic forms of pores and friction ridges; Federal Office of Police fedpol, AFIS DNA Services
[67] Image of two palmprints showing twelve corresponding minutiae (left: crime scene print; right: reference print from a database); Federal Office of Police fedpol, AFIS DNA Services
[68] Swiss passport of Albert Einstein (1923); Bern Historical Museum
[70] Swiss passports since' 1915; Federal Office of Police fedpol

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