SWGFAST

Defining Level Three Detail

ANSI / NIST Workshop

Data Format for the Interchange of Fingerprint, Facial, & Scar Mark & Tattoo (SMT) Information

April 26-28,2005

Defining Level Three Detail

- Background
  - Development of AFIS technology needed to achieve throughput and performance for large volume processing.
    - Primary focus on 10-print fingerprints
    - Started with minimal amount of fingerprint information, e.g. finger position, fingerprint classification, minutiae (ending ridges and bifurcations – limited level two detail)
    - 10-print searching and matching success promoted exploration into latent print searching and matching.

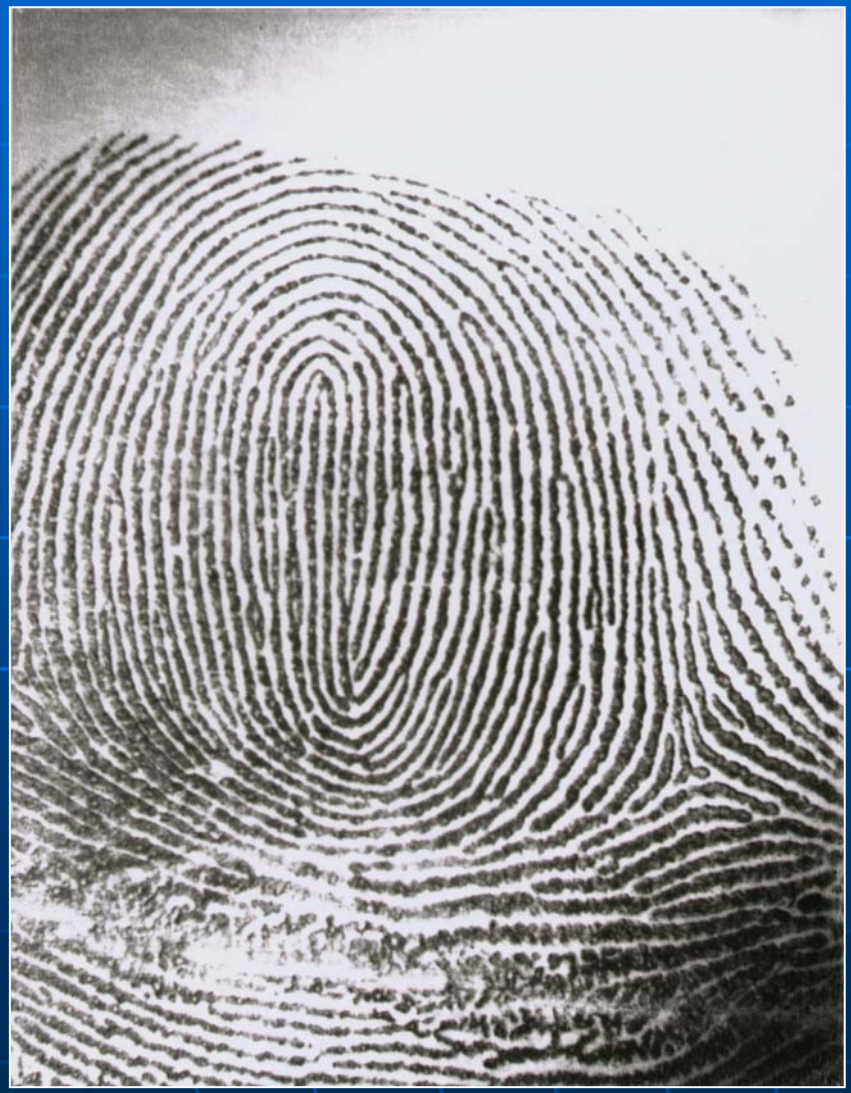
Defining Level Three Detail

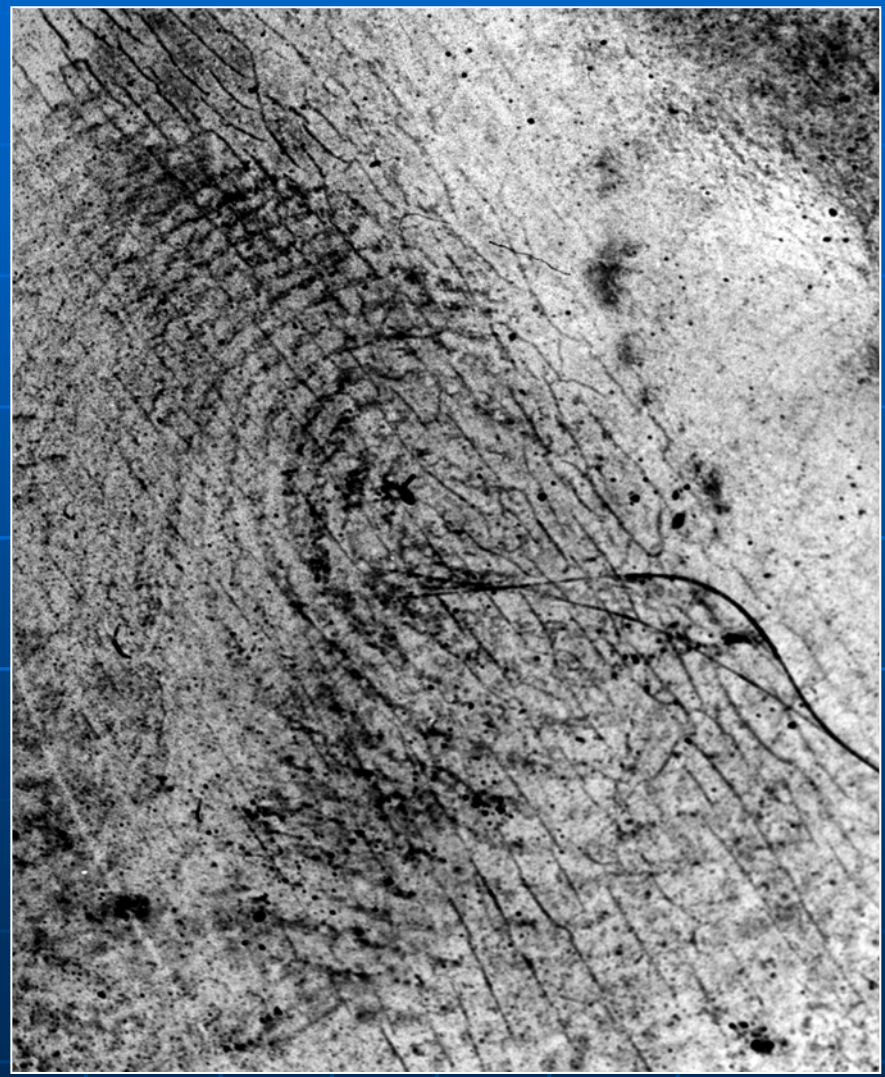
- Background continued:
  - Development of latent print searching and matching attempted to exploit existing data from 10-print AFIS technology
    - Very limited information available in comparison to what and how the latent print community utilizes.
    - Resulted in limited application
      - Not all latent prints could be processed through an AFIS

Defining Level Three Detail

- Background continued:
  - 10-Print Fingerprint image quality and AFIS minutiae extraction algorithms are key factors in latent print performance (accuracy)
    - Early development was hampered by cost factors and politics.
    - Image quality remains a key factor today
      - Fingerprint quality vs. digital image quality

(see part 2 of this presentation)





Defining Level Three Detail

- If we were to build a ALPIS today, what approach would we take to achieve:
  - Accuracy
    - Selectivity / Reliability
  - Throughput
  - Connectivity
  - Interoperability
  - Future goals and objectives

Defining Level Three Detail

- But, we can't start from scratch because of the legacy systems, however, we could migrate towards achieving those latent print needs and start with a day-one forward approach,

TODAY IS AS GOOD AS ANY

Defining Level Three Detail

- Applications of friction ridge impressions
  - Criminal record keeping (Informational)
  - Forensic science (Investigative)
  - Personal identification (Humanitarian)
  - Security (Safety)
  - 1:n and/or 1:1 (identification / verification)
- Where do latent prints fall in the big picture?

Defining Level Three Detail

- Each and all are very important.
- We need to provide a standard that will support the needs of each application without a detriment to another.
- It all starts with the finger...
  - What does that mean to each of us; to each application???

Defining Level Three Detail

- All 10 fingers, rolled and plain, intentionally (controlled) recorded
- Two fingers, one from each hand, plain impressions, intentionally recorded
- One fragmentary portion of a finger, intentionally recorded
- One friction ridge impression of varying size, unintentional impression (latent print)
- Many, many more variations

Defining Level Three Detail

- It is time to move beyond just ending ridges and bifurcations for any and all of these applications.
- So, what else is there?
  - Three levels of detail
    - Limitations of two dimensional images
  - Is there a fourth, fifth level?
    - Three dimensional images

EXHIBIT 10a
Levels of Friction Ridge Detail

- Level 1, Ridge Flow
  - Orientation
  - Classification
    - arch, loop, whorl
    - ridge count
  - Focal areas
    - core, delta
- Individualization can **NOT** occur at this level
  - However, EXCLUSIONS

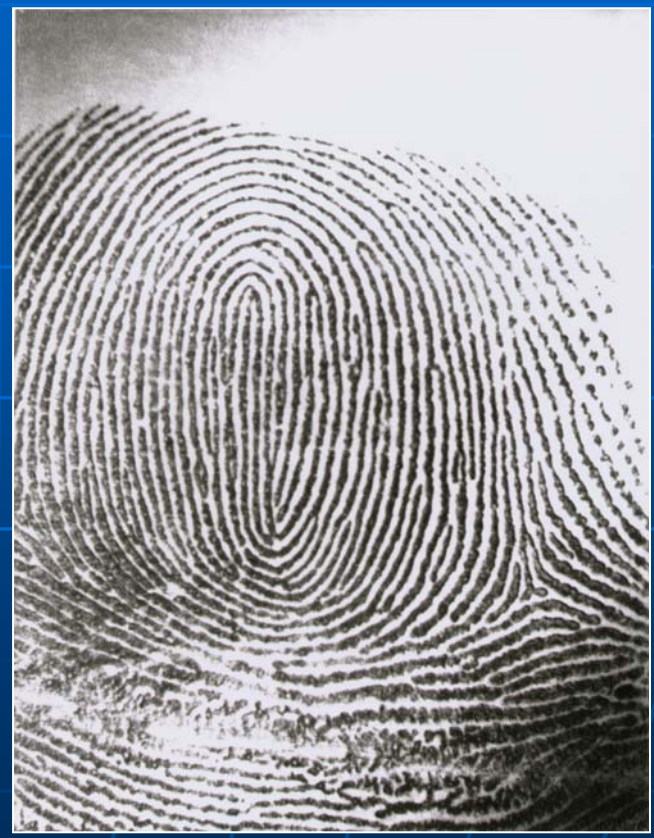


EXHIBIT 10b

Levels of Friction Ridge Detail

- Level 2, Ridge Path
  - Characteristics (Galton Points)
    - ending ridge
    - bifurcation
    - dot
    - combinations
    - Location, type, direction and relationship
  - Absence of characteristics
- Individualization **CAN** occur at this level with level 1

EXHIBIT 10c
Levels of Friction Ridge Detail

- Level 3, Ridge Features
  - pores
  - edge shapes
  - width
  - relationship
- Individualization **CAN** occur at this level with levels 1 and 2 detail

EXHIBIT 17
Methodology of Friction Ridge Identification

A nalysis

C omparison

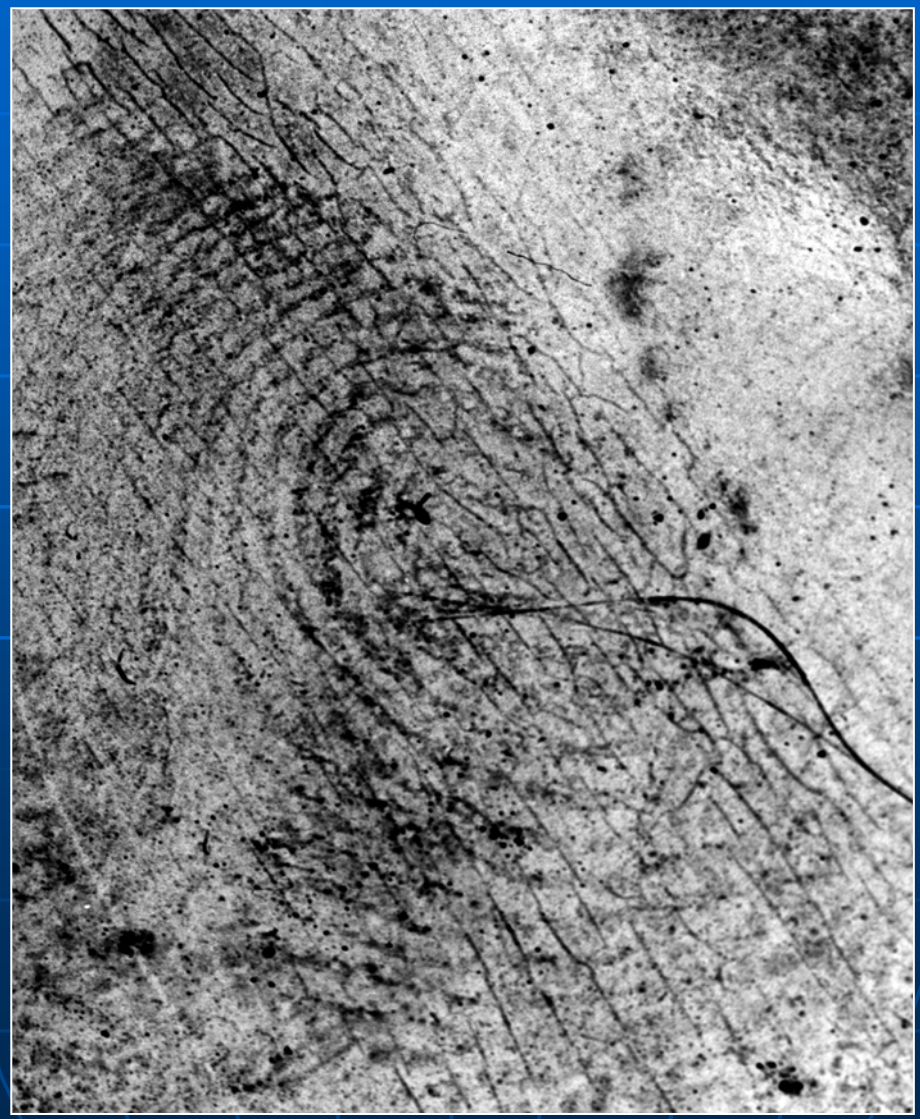
E valuation

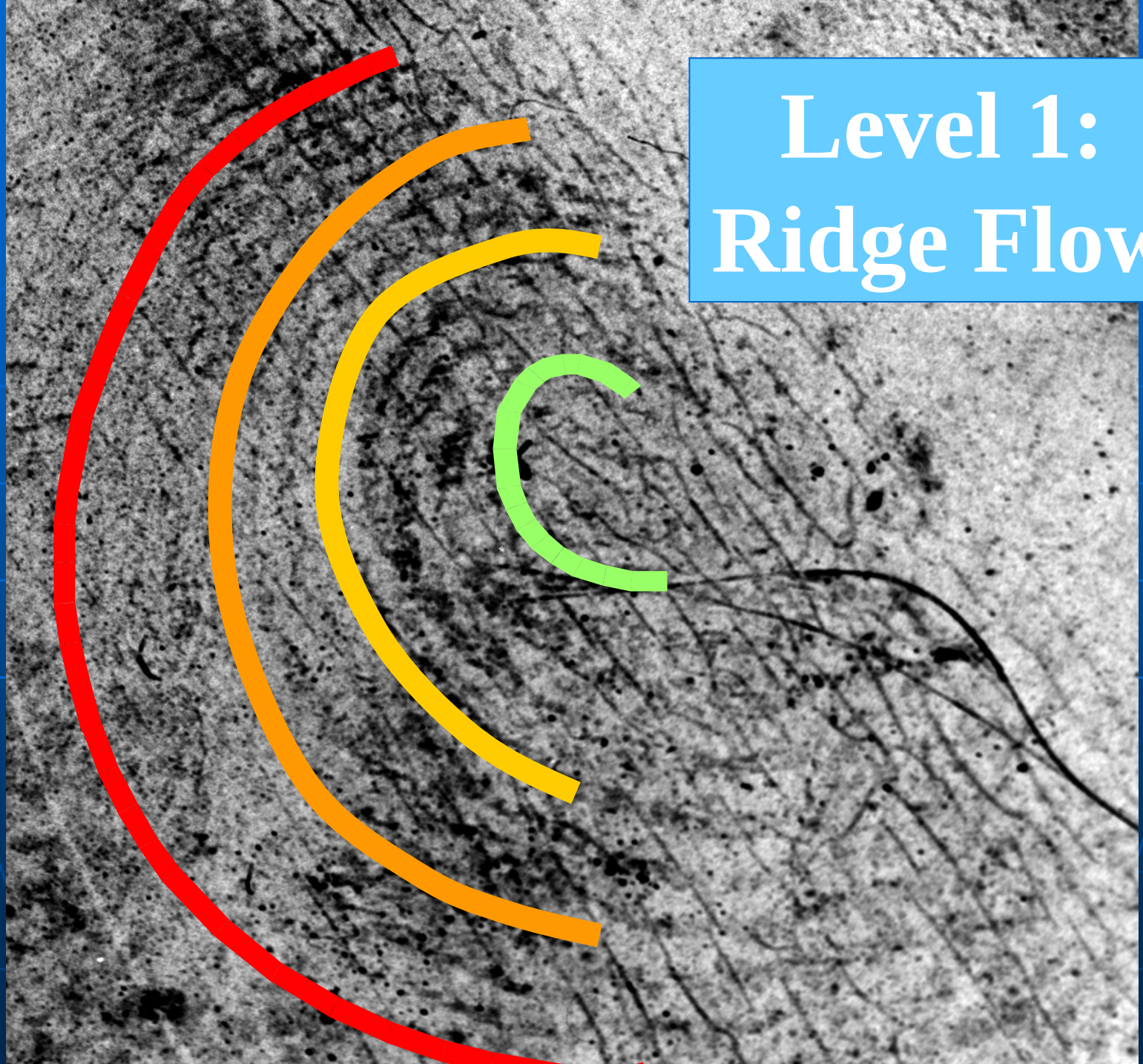
V erification

Analysis

- Level 1 Detail: Ridge Flow
  - core, delta(s), scars, classification, and orientation
- Level 2 Detail: Ridge Path
  - characteristics (ending ridge, bifurcation, dot)
  - location, type, direction, and relationship
  - absence of characteristics
- Level 3 Detail: Ridge Attributes
  - edge shape, width, and pores

The Latent Print

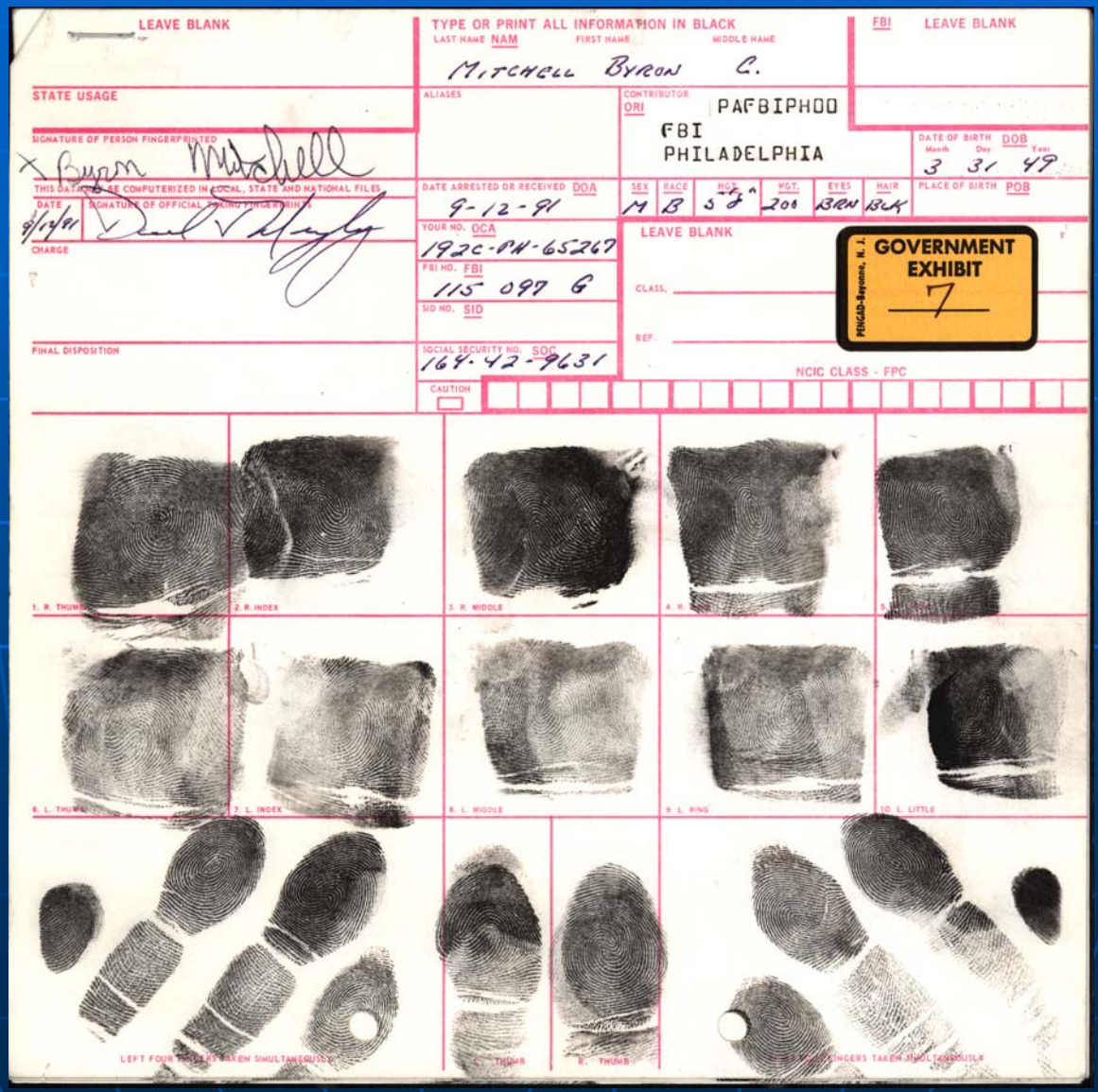



Level 1:
Ridge Flow

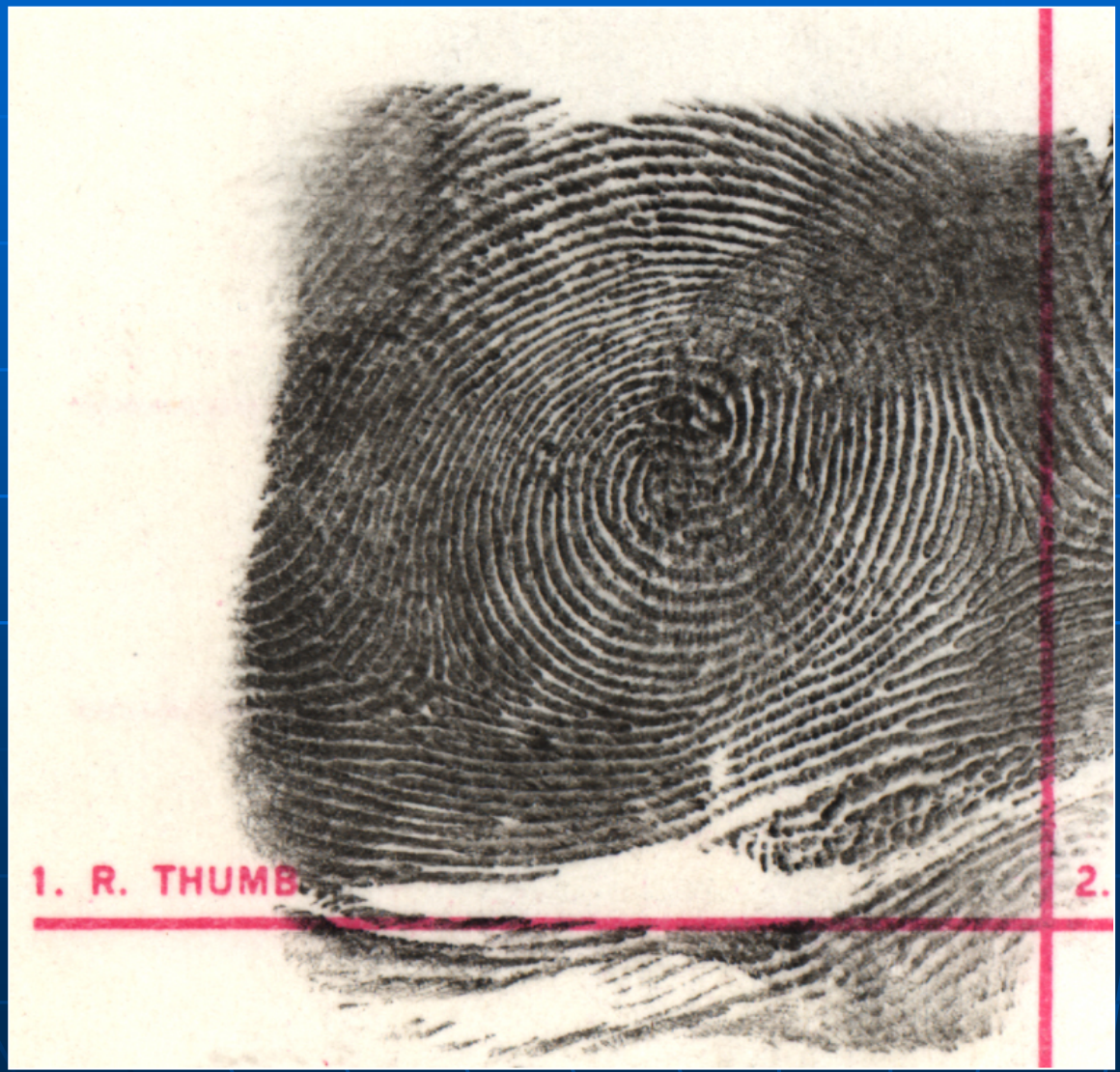
Level 2: Ridge Path

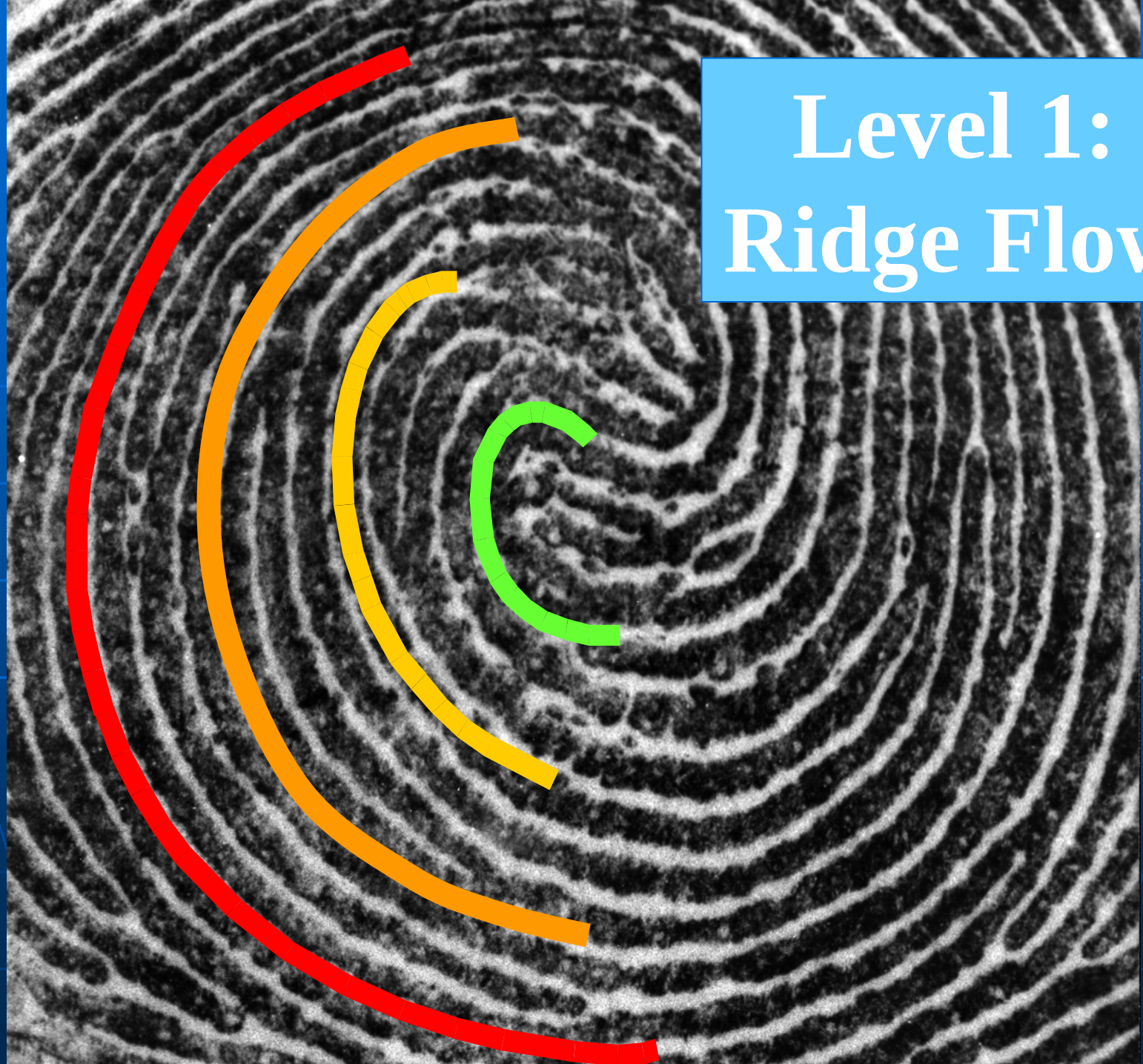
Details with Relationship

Known Exemplar

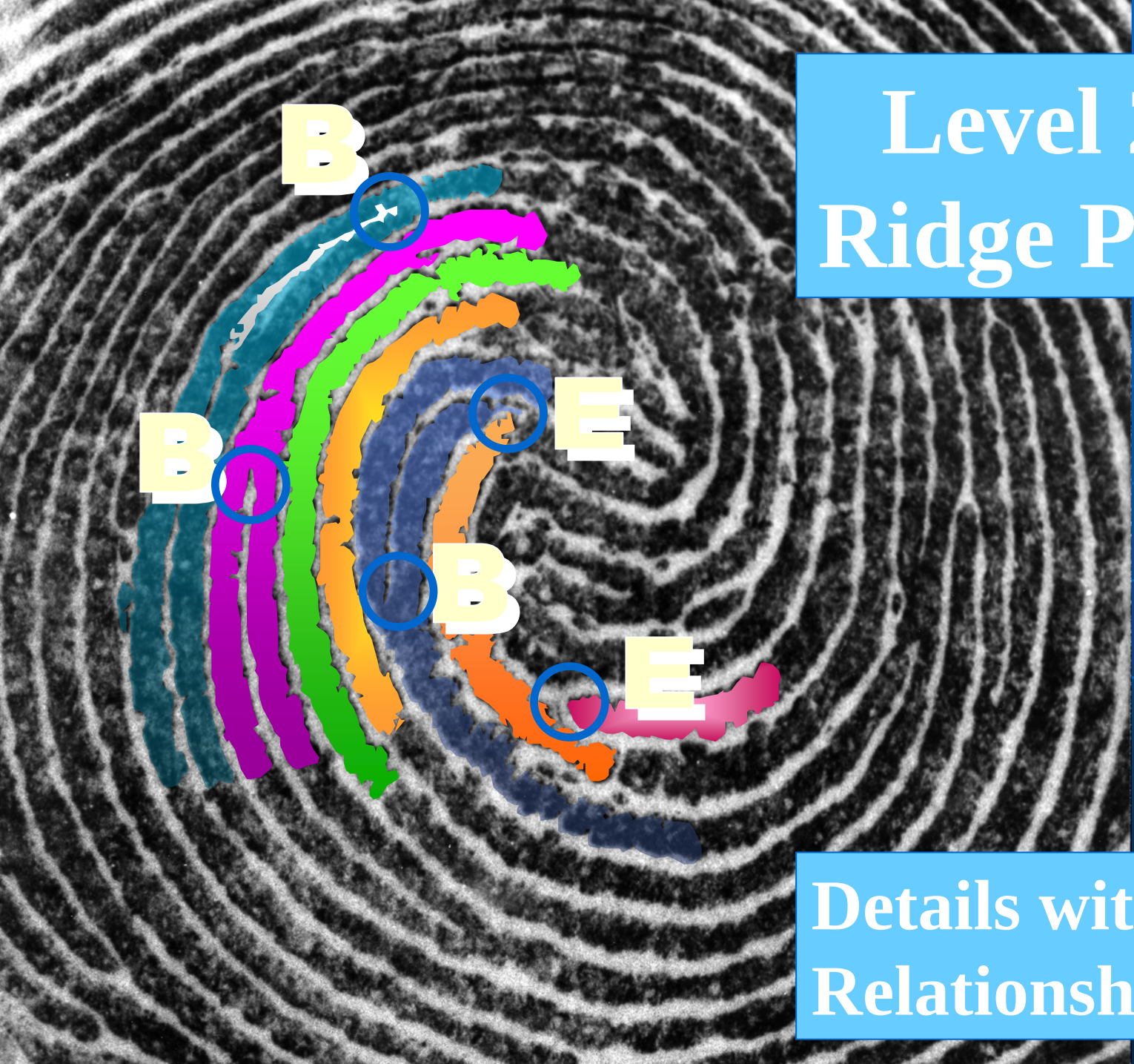


Right Thumb





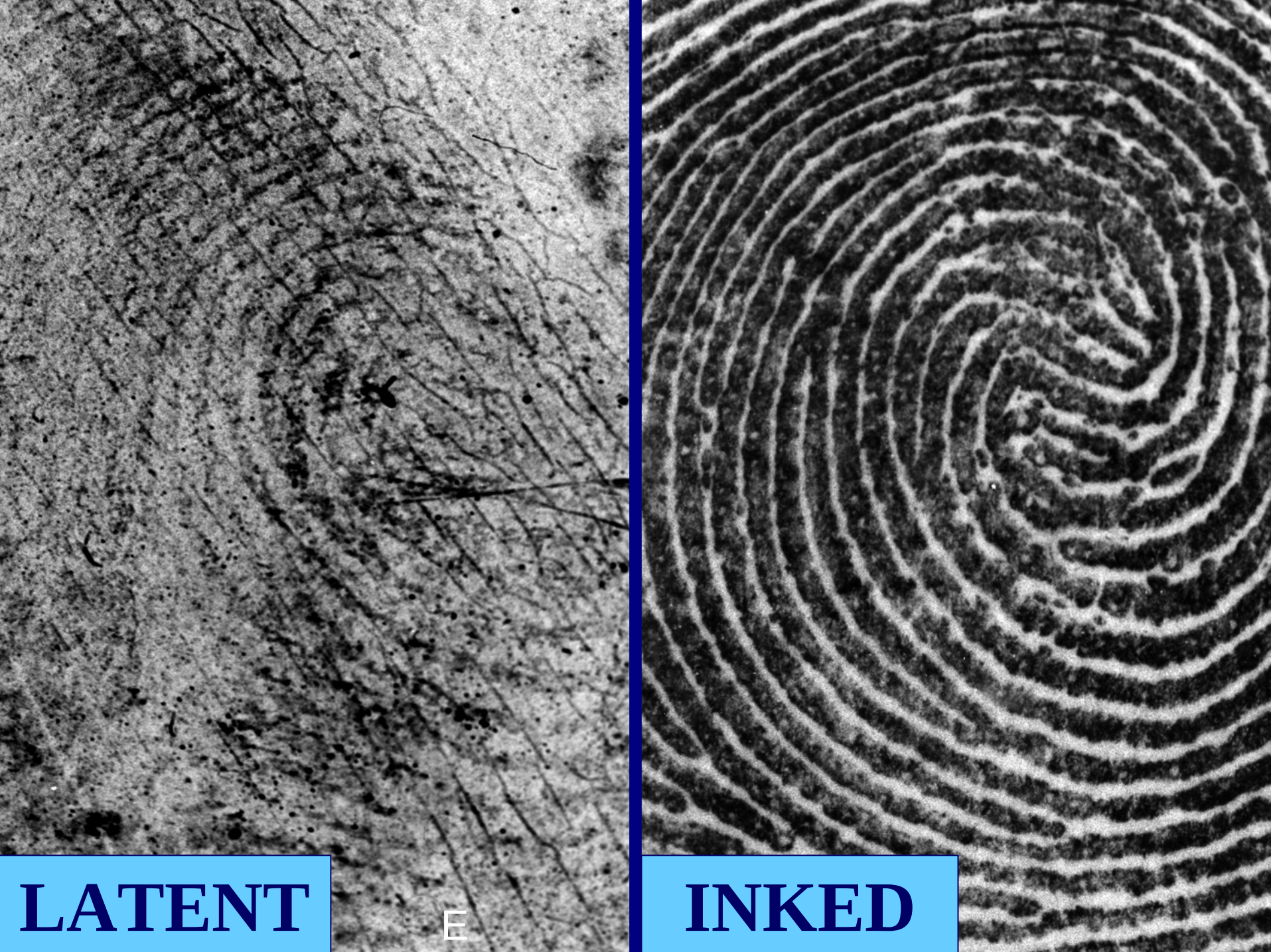
Level 1: Ridge Flow



Level 2: Ridge Path

Details with Relationship

Comparison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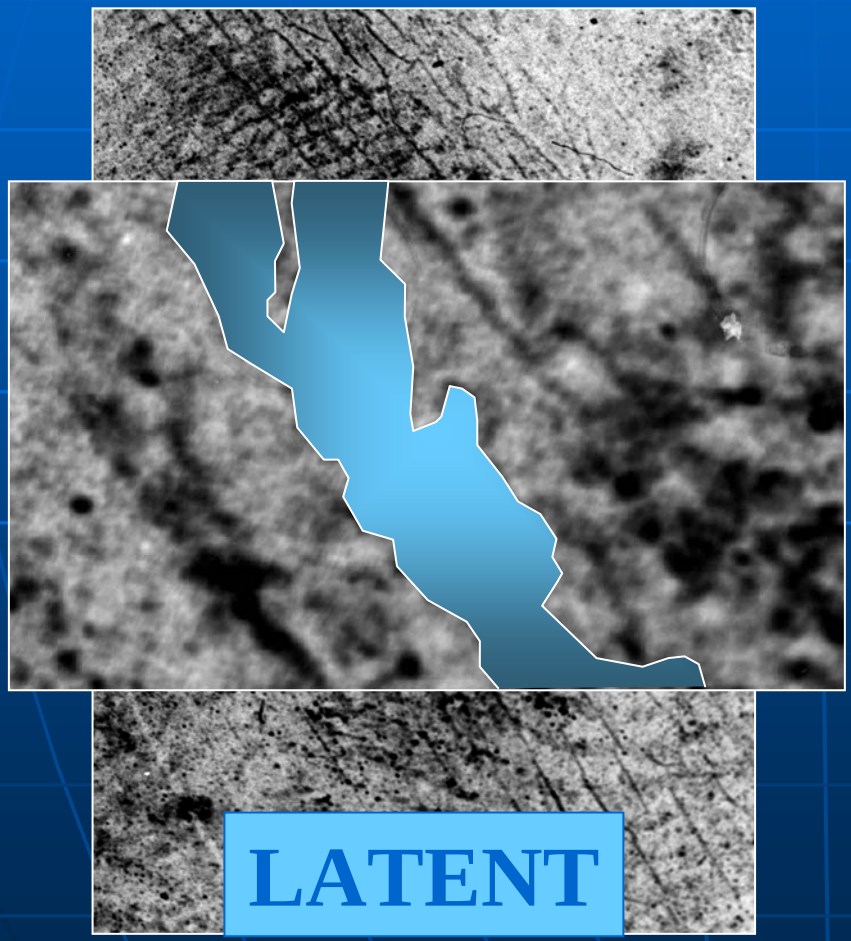
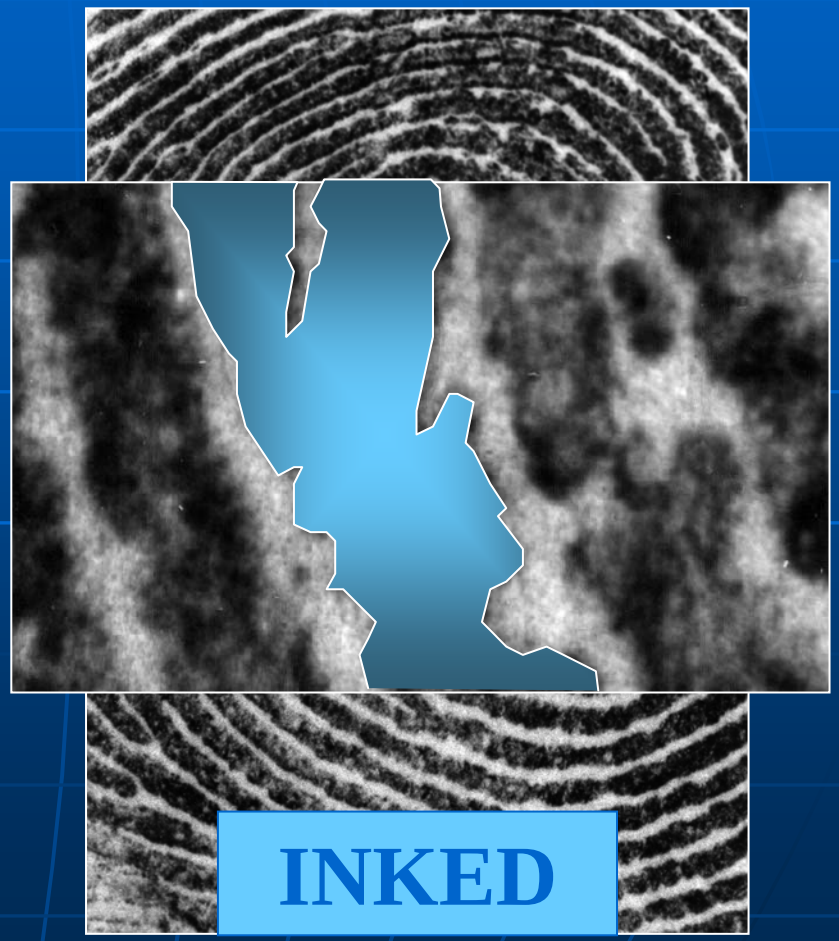
Level 3: Ridge Attributes





Qualitative and Quantitative Process

The quality of the ridge detail along with the quantity of all three levels of detail is used to effect an individualization.

Evaluation

- Level 1 Detail
  - Approximately 18 ridges in agreement in both prints, with no discrepancies
- Level 2 Detail
  - 14 characteristics which are in the same location, direction, and relationship, with no discrepancies
- Level 3 Detail
  - Several features in agreement in both prints, with no discrepancies

Verification

- All identifications are verified by another qualified examiner
- Quality Assurance
- Peer Review - part of the scientific process

Defining Level Three Detail

- How do we define:
  - Ridge path
    - With deviations (endings, bifurcations, enclosures, etc.)
    - Without deviations (continuous ridges)
  - Ridge paths in sequence
  - Dots
  - Incipient ridges
  - Ridge attributes
    - Ridge widths, edge shapes, pores
  - Scars
  - Creases
  - Other (warts, blisters, etc.)

Defining Level Three Detail

- Current standard defines minutiae
  - X,Y, Theta
    - Type 9 Minutiae data record
  - Lacks ridge path
  - Absence of minutiae is not adequately addressed

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Minimum Scan Resolution

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Minimum Scan Resolution

- Simply stated - the current standard for 10-print fingerprint capture at 500ppi with 15:1 WSQ compression:
  - hampers the ACE-V methodology for latent print examinations;
  - does not capture detail with sufficient clarity for the confidence needed by an expert;
  - Was a compromise based on 1993 costs and politics.
  - 1000ppi is merely a “strong recommendation”

Minimum Scan Resolution

- 1000ppi capture technology is now available and affordable
- Storage is affordable
- Transmission is affordable
- JPEG2000 is compression of choice
- 10:1 compression reduces, if not eliminates, image clarity loss attributable to a lossy technique.

Minimum Scan Resolution

- SWGFAST PROPOSAL
  - The normal mode of finger- and palm print image capture should be 1000ppi minimum scan resolution. Images should be compressed using JPEG2000, not to exceed 10:1 compression. Legacy compatible 500ppi image capture and processing should be permitted.

Minimum Scan Resolution

- Day one forward proposal
- Image capture, storage and transmission is focus
- AFIS technology at 500ppi images is still workable

Defining Level Three Detail and 1000ppi Capture Resolution

- QUESTION

  How important is preventing terrorist acts and solving crimes?