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Crime Scene Investigation

## Evidence Collection

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### Accession Number

Concept: Unique identifier assigned to each piece of evidence when it enters the laboratory.

Related terms: evidence tag, chain of custody.

Explanation: The accession number links the physical item to all documentation, ensuring traceability throughout analysis.

Example: A blood-stained swab receives accession number 2023-00123.

Practical application: Facilitates database searches and retrieval for future review.

Challenges: Mis-recording or duplication can break the evidentiary link and jeopardize admissibility.

### Admissibility

Concept: Legal standard determining whether evidence may be presented in court.

Related terms: relevance, probative value, hearsay.

Explanation: Evidence must be relevant, reliable, and obtained lawfully to be admissible.

Example: A fingerprint lifted with proper technique is admissible, whereas a contaminated sample may be excluded.

Practical application: Guides investigators in collection methods to meet judicial requirements.

Challenges: Defense challenges may argue constitutional violations or chain-of-custody gaps.

### Alcohol Swab

Concept: Small cotton swab pre-moistened with isopropyl alcohol used for surface cleaning.

Related terms: sterile swab, collection kit.

Explanation: Used to sterilize a surface before collecting trace evidence, preventing cross-contamination.

Example: An officer swabs the handle of a pistol before gathering latent prints.

Practical application: Ensures that only target material is collected from a suspect area.

Challenges: Over-wetting can degrade DNA, while insufficient cleaning may leave residual contaminants.

### Archival Storage

Concept: Long-term preservation method for evidence that may be needed in future proceedings.

Related terms: climate-controlled facility, evidence vault.

Explanation: Evidence is stored under controlled temperature, humidity, and lighting to prevent degradation.

Example: Fire-arm cartridges are kept in a low-humidity cabinet for up to ten years.

Practical application: Allows re-examination with new technologies such as advanced DNA profiling.

Challenges: Space limitations and resource costs can restrict optimal storage conditions.

### Audio Surveillance

Concept: Recording of ambient sound at a crime scene for investigative or evidentiary purposes.

Related terms: covert recording, forensic audio.

Explanation: Captures verbal statements, background noises, and acoustic signatures that may corroborate other evidence.

Example: A hidden microphone records a suspect's confession in a suspect's vehicle.

Practical application: Provides corroborative evidence when visual cues are limited.

Challenges: Legal restrictions on consent, background noise interference, and equipment reliability.

#### Ballistics Examination

Concept: Scientific analysis of firearms, ammunition, and related markings.

Related terms: firearm identification, tool mark analysis.

Explanation: Determines the source of a projectile by comparing striations and impressions on bullets and casings.

Example: Matching a recovered 9mm bullet to a suspect's handgun.

Practical application: Links a weapon to a crime, supporting prosecution.

Challenges: Surface damage, incomplete recovery, and limited comparison databases can impede accurate matches.

#### Biological Sample

Concept: Any tissue, fluid, or cellular material that may contain DNA or other biological markers.

Related terms: DNA evidence, forensic pathology.

Explanation: Collected for genetic profiling, toxicology, or serological testing.

Example: Saliva on a cigarette butt is a biological sample.

Practical application: Establishes identity or presence of individuals at a scene.

Challenges: Degradation due to heat, moisture, or time can reduce analytical value.

#### Chain of Custody

Concept: Documented chronological record of evidence handling from collection to presentation.

Related terms: evidence log, accession number.

Explanation: Every transfer, storage, and analysis step is recorded to maintain integrity.

Example: A signed chain-of-custody form notes each officer who handled a murder weapon.

Practical application: Provides courts confidence that evidence has not been altered.

Challenges: Gaps or inconsistencies can lead to evidence suppression.

#### Cold Case Review

Concept: Re-examination of unsolved crimes using new techniques or information.

Related terms: case file, forensic re-analysis.

Explanation: Revisits evidence with advanced technologies such as next-generation DNA sequencing.

Example: Re-testing hair from a 1998 homicide leads to a DNA match.

Practical application: Offers closure to victims' families and potential convictions.

Challenges: Deteriorated evidence and limited resources may hinder progress.

### Contamination Control

Concept: Procedures designed to prevent introduction of foreign material into evidence.

Related terms: sterile technique, personal protective equipment (PPE).

Explanation: Involves using gloves, masks, and clean tools, and maintaining separate work areas.

Example: Wearing nitrile gloves while collecting a bloodstain to avoid DNA transfer.

Practical application: Preserves the purity of the sample for accurate analysis.

Challenges: Human error and inadequate training can compromise control measures.

### Coroner's Report

Concept: Official document summarizing findings from a post-mortem examination.

Related terms: autopsy report, death certificate.

Explanation: Details cause and manner of death, toxicology results, and any injuries observed.

Example: The report indicates death by blunt force trauma with alcohol intoxication.

Practical application: Provides crucial information for criminal investigations and court testimony.

Challenges: Variability in report detail and potential bias can affect investigative direction.

### Crime Scene Tape

Concept: Physical barrier used to secure a crime scene from unauthorized entry.

Related terms: evidence perimeter, red tape.

Explanation: Typically bright orange or red, the tape demarcates the restricted area.

Example: Yellow police tape encircles a burglary site to preserve evidence.

Practical application: Prevents contamination and maintains scene integrity.

Challenges: Improper placement can obscure evidence or impede first responders.

### Cross-Contamination

Concept: Transfer of material from one sample to another, potentially creating false associations.

Related terms: contamination, evidence integrity.

Explanation: Occurs when tools or personnel inadvertently introduce foreign DNA or substances.

Example: Using the same swab on two different surfaces without changing gloves.

Practical application: Highlighted in training to reinforce strict protocols.

Challenges: Difficult to detect after the fact, leading to wrongful convictions or acquittals.

### DNA Profiling

Concept: Laboratory technique that generates a genetic fingerprint unique to an individual.

Related terms: STR analysis, mitochondrial DNA.

Explanation: Amplifies specific DNA regions to compare with known samples.

Example: Matching a suspect's DNA to a semen stain recovered from a victim.

Practical application: Provides strong evidentiary support for identification.

Challenges: Low-quantity or degraded samples may produce partial profiles, requiring careful interpretation.

### Digital Evidence

Concept: Information stored or transmitted in electronic form that may be used in legal proceedings.

Related terms: computer forensics, metadata.

Explanation: Includes files, logs, emails, and images retrieved from devices.

Example: Extracting a deleted text message from a suspect's smartphone.

Practical application: Can establish timelines, motives, or alibis.

Challenges: Rapid technology changes, encryption, and jurisdictional issues complicate collection.

### Disposal Protocol

Concept: Procedure for safely discarding evidence that is no longer needed.

Related terms: evidence destruction, chain of custody.

Explanation: Involves documentation, secure transport, and compliance with legal standards.

Example: Shredding counterfeit money seized during an operation.

Practical application: Prevents misuse of discarded items and maintains confidentiality.

Challenges: Ensuring complete destruction and proper documentation to avoid accusations of tampering.

### Document Examination

Concept: Analytical process that assesses the authenticity and origin of written or printed material.

Related terms: forensic document analysis, handwriting comparison.

Explanation: Evaluates ink, paper, typeface, and alterations.

Example: Determining that a forged signature was created using a ballpoint pen.

Practical application: Supports fraud investigations and validates contracts.

Challenges: Subtle variations and skilled forgeries demand high expertise.

### Evidence Bag

Concept: Sealed container used to transport collected items while protecting them from contamination.

Related terms: evidence container, tamper-evident seal.

Explanation: Often made of nylon or paper with a zip lock and evidence tag attached.

Example: Placing a torn piece of clothing into a paper evidence bag.

Practical application: Maintains sample integrity during movement between locations.

Challenges: Inappropriate bag material may cause moisture buildup or static damage.

### Evidence Log

Concept: Chronological record of all evidence received, processed, and released.

Related terms: chain of custody, accession number.

Explanation: Includes details such as description, location, and responsible personnel.

Example: An entry notes that evidence #2023-00123 was transferred to the forensic lab on June 1.

Practical application: Enables auditors to verify handling procedures.

Challenges: Incomplete entries or illegible handwriting can undermine credibility.

### Evidence Preservation

Concept: Methods employed to maintain the condition of collected items until analysis.

Related terms: archival storage, contamination control.

Explanation: Includes temperature regulation, protective packaging, and avoidance of light exposure.

Example: Storing blood samples at 4°C to prevent bacterial growth.

Practical application: Ensures that later testing yields reliable results.

Challenges: Resource constraints may limit optimal preservation environments.

#### Fiber Analysis

Concept: Microscopic examination of textile fibers to link a suspect or object to a crime scene.

Related terms: trace evidence, microscopy.

Explanation: Determines fiber type, color, weave, and any unique characteristics.

Example: Matching a carpet fiber found on a victim's clothing to a specific carpet manufacturer.

Practical application: Provides associative evidence when other links are weak.

Challenges: High prevalence of common fibers can reduce discriminative power.

#### Forensic Anthropology

Concept: Scientific study of human skeletal remains to assist in identification and cause of death.

Related terms: osteology, skeletal analysis.

Explanation: Determines age, sex, ancestry, and trauma patterns from bones.

Example: Identifying a skull as belonging to a male aged 30-35 years.

Practical application: Helps locate missing persons and supports homicide investigations.

Challenges: Fragmented remains and post-mortem damage can limit conclusions.

#### Forensic Entomology

Concept: Use of insects and their developmental stages to estimate post-mortem intervals.

Related terms: blowfly larvae, decomposition timeline.

Explanation: Analyzes species present on a corpse and calculates time since death.

Example: Determining that a body has been deceased for 48 hours based on maggot growth.

Practical application: Provides time-frame evidence when other data are unavailable.

Challenges: Environmental variables such as temperature and humidity affect insect development rates.

#### Fingerprint Lift

Concept: Technique for transferring latent prints from a surface onto a backing material for analysis.

Related terms: latent print, powder dusting.

Explanation: Uses adhesive tape or gel lifters to capture the print without distortion.

Example: Applying a clear adhesive tape to a glass door to retrieve a fingerprint.

Practical application: Preserves prints for comparison against known databases.

Challenges: Porous surfaces may yield incomplete lifts, and moisture can cause smearing.

#### Forensic Light Source (FLS)

Concept: Specialized illumination equipment used to reveal hidden evidence.

Related terms: alternate light source, UV light.

Explanation: Emits specific wavelengths (e.g., UV, infrared) to enhance stains, fibers, or bodily fluids.

Example: Using a 415 nm blue light to visualize bloodstains invisible to the naked eye.

Practical application: Increases detection rates of trace evidence.

Challenges: Incorrect wavelength selection can produce false positives or miss evidence.

### Garbage Can Test

Concept: Rapid field method for assessing whether a surface may contain biological material.

Related terms: presumptive test, immunoassay.

Explanation: Applies a reagent that changes color in the presence of blood, saliva, or semen.

Example: A pink color appears after applying the Kastle-Meyer test to a stain.

Practical application: Allows investigators to prioritize samples for laboratory analysis.

Challenges: Cross-reactivity with non-target substances can lead to false positives.

### Heat-Sensitive Dye

Concept: Chemical indicator that changes color when exposed to elevated temperatures.

Related terms: temperature mapping, forensic chemistry.

Explanation: Placed on evidence containers to detect improper storage conditions.

Example: A dye turns orange if a blood sample is stored above 30 °C for prolonged periods.

Practical application: Alerts technicians to potential degradation before analysis.

Challenges: Dyes may be affected by ambient light or humidity, requiring careful calibration.

### Human Remains Identification (HRI)

Concept: Process of establishing the identity of deceased individuals using forensic methods.

Related terms: DNA profiling, dental records.

Explanation: Combines multiple data sources such as DNA, fingerprints, and osteological features.

Example: Matching a victim's dental X-ray to a missing person's record.

Practical application: Provides closure for families and legal closure for investigations.

Challenges: Fragmented remains and lack of ante-mortem records can impede identification.

### Impression Evidence

Concept: Physical marks left on a surface by an object, such as shoeprints or tire tracks.

Related terms: pattern analysis, class characteristics.

Explanation: Captured by casting, photography, or digital scanning for comparison.

Example: Casting a shoeprint in a mud-filled alleyway using dental stone.

Practical application: Links a suspect's footwear to a crime scene.

Challenges: Distortion from environmental factors and incomplete impressions reduce reliability.

### Immunochromatographic Test

Concept: Rapid, point-of-care assay that detects specific antigens using antibodies.

Related terms: lateral flow assay, presumptive test.

Explanation: A sample migrates along a membrane; a visible line indicates presence of the target.

Example: A rapid test indicating the presence of human hemoglobin in a stain.

Practical application: Provides quick screening results on scene.

Challenges: Sensitivity may be lower than laboratory methods, leading to false negatives.

#### Incineration

Concept: Controlled burning of evidence that cannot be retained or poses biohazard risks.

Related terms: evidence destruction, disposal protocol.

Explanation: Conducted in a secure furnace with temperature monitoring to ensure complete combustion.

Example: Incinerating a batch of counterfeit documents after the case concludes.

Practical application: Guarantees irreversible destruction of sensitive material.

Challenges: Requires documentation to prove compliance and prevent allegations of evidence tampering.

#### Instrumental Analysis

Concept: Use of scientific instruments to examine evidence at a molecular level.

Related terms: spectrometry, chromatography.

Explanation: Techniques such as GC-MS or FTIR identify chemical compositions.

Example: Analyzing paint chips with Fourier-transform infrared spectroscopy to determine polymer type.

Practical application: Provides definitive identification of unknown substances.

Challenges: Requires specialized equipment, trained analysts, and may be time-consuming.

#### Judicial Notice

Concept: Court's acceptance of a fact as true without requiring formal proof.

Related terms: evidentiary rule, admissibility.

Explanation: Applies when information is widely known or easily verifiable.

Example: A court taking judicial notice that a certain chemical has a known boiling point.

Practical application: Streamlines proceedings by avoiding unnecessary expert testimony.

Challenges: Misapplication can lead to acceptance of inaccurate or disputed facts.

#### K-Fit Test

Concept: Statistical method used to assess the likelihood that a DNA profile matches a suspect.

Related terms: likelihood ratio, random match probability.

Explanation: Calculates the probability that a profile would occur in the general population.

Example: A K-Fit value of 1 in 10 million supports a strong match.

Practical application: Assists jurors in understanding DNA evidence weight.

Challenges: Requires accurate population databases and may be misinterpreted by lay audiences.

#### Latent Print Development

Concept: Process of visualizing invisible fingerprints on various substrates.

Related terms: powder dusting, cyanoacrylate fuming.

Explanation: Uses chemicals or physical methods to make prints visible for collection.



Example: Applying cyanoacrylate fumes to a plastic bag to reveal a latent print.

Practical application: Enables capture of prints that would otherwise remain hidden.

Challenges: Certain surfaces (e.g., oily or wet) may resist development, and some chemicals can damage evidence.

### Legal Hold

Concept: Directive to preserve all potentially relevant evidence for litigation.

Related terms: evidence preservation, discovery.

Explanation: Requires organizations to suspend routine disposal of electronic or physical records.

Example: A police department issuing a legal hold on all body-camera footage related to an ongoing homicide case.

Practical application: Prevents spoliation and ensures compliance with discovery obligations.

Challenges: Coordination across departments and maintaining chain of custody over extended periods.

### Logistics Chain

Concept: Coordination of resources, transport, and personnel involved in evidence handling.

Related terms: evidence transport, chain of custody.

Explanation: Ensures timely, secure movement of items from collection to laboratory.

Example: Scheduling a sealed courier service to deliver narcotics evidence to a federal lab.

Practical application: Reduces delays and risks of loss or damage.

Challenges: Geographic distance, limited secure vehicles, and scheduling conflicts can cause bottlenecks.

### Material Transfer Tape (MTT)

Concept: Transparent adhesive tape used to lift trace evidence such as fibers or hairs.

Related terms: tape lift, evidence collection kit.

Explanation: Pressed onto a surface, the tape adheres particles that are then examined under a microscope.

Example: Using MTT to collect hair strands from a victim's clothing.

Practical application: Provides a non-destructive method for gathering minute evidence.

Challenges: Over-application can embed the sample too deeply, making later extraction difficult.

### Microspectrophotometry (MSP)

Concept: Analytical technique that measures light absorption of a microscopic sample.

Related terms: forensic chemistry, color analysis.

Explanation: Determines the composition of pigments, fibers, or inks by their spectral signature.

Example: Comparing the MSP profile of a paint chip to a known automotive paint database.

Practical application: Differentiates visually similar materials for source attribution.

Challenges: Requires highly specialized equipment and skilled interpretation.

### Modus Operandi (MO)

Concept: The characteristic method or pattern a perpetrator uses to commit crimes.

Related terms: behavioral profile, signature.



Explanation: Helps investigators link multiple incidents to a single offender.

Example: A burglar who always disables security alarms before entry.

Practical application: Guides investigative focus and resource allocation.

Challenges: Offenders may change tactics, and overlapping MOs can create false connections.

### Mounting Medium

Concept: Substance used to preserve and adhere microscopic samples onto slides.

Related terms: slide preparation, microscopy.

Explanation: Provides optical clarity and prevents sample distortion.

Example: Using Canada balsam to mount a hair shaft for comparison.

Practical application: Ensures long-term stability of specimens for repeated analysis.

Challenges: Incompatible mediums can cause fading or chemical reactions with the sample.

### Multidisciplinary Team (MDT)

Concept: Group of professionals from various forensic specialties collaborating on a case.

Related terms: case management, interdisciplinary approach.

Explanation: Combines expertise such as DNA analysts, toxicologists, and digital forensics to enhance investigation outcomes.

Example: An MDT reviewing a homicide case includes a pathologist, ballistics expert, and forensic psychologist.

Practical application: Provides comprehensive insight and reduces investigative blind spots.

Challenges: Communication barriers and differing priorities may hinder coordinated effort.

### Near-Infrared (NIR) Imaging

Concept: Use of NIR wavelengths to detect substances that reflect or absorb infrared light.

Related terms: forensic imaging, alternate light source.

Explanation: Reveals hidden stains, such as semen or urine, that are not visible under normal lighting.

Example: Capturing a NIR image of a mattress to locate invisible blood spots.

Practical application: Increases detection of trace evidence, especially on dark fabrics.

Challenges: Requires calibrated equipment and may produce artifacts if ambient light is uncontrolled.

### Neutron Activation Analysis (NAA)

Concept: Non-destructive analytical technique that determines elemental composition by measuring gamma radiation after neutron exposure.

Related terms: elemental analysis, forensic chemistry.

Explanation: Provides precise identification of trace elements in glass, soil, or metal.

Example: Matching glass fragments from a crime scene to a suspect's vehicle windshield.

Practical application: Offers high discrimination power for source attribution.

Challenges: Requires access to a nuclear reactor and specialized facilities, limiting routine use.

### Non-Destructive Testing (NDT)

Concept: Examination methods that preserve the original condition of evidence while gathering data.

Related terms: NDT, forensic imaging.

Explanation: Includes techniques like X-ray radiography, CT scanning, and Raman spectroscopy.

Example: Using CT scanning to visualize internal bullet paths in a recovered firearm.

Practical application: Allows investigators to examine evidence without altering it for later re-analysis.

Challenges: Equipment cost and need for specialized training may restrict deployment.

#### Officer-Involved Shooting (OIS) Investigation

Concept: Formal inquiry into a police shooting to determine legality and appropriateness.

Related terms: use-of-force, forensic reconstruction.

Explanation: Involves collecting ballistic evidence, autopsy reports, and witness statements.

Example: Recovering spent shell casings and analyzing trajectory to assess officer actions.

Practical application: Provides transparency and accountability in law-enforcement operations.

Challenges: High public scrutiny and potential conflicts of interest require meticulous documentation.

#### Optical Microscopy

Concept: Use of visible light and lenses to magnify small samples for examination.

Related terms: bright-field microscopy, polarized light microscopy.

Explanation: Allows observation of morphology, texture, and color of trace evidence.

Example: Examining fiber cross-section under a microscope to determine weave pattern.

Practical application: Fundamental tool for many forensic disciplines.

Challenges: Limited resolution for sub-micron particles; preparation must avoid contamination.

#### Paraben Testing

Concept: Chemical assay to detect presence of common preservatives used in cosmetics and personal care products.

Related terms: presumptive test, forensic chemistry.

Explanation: Identifies trace amounts that can link a suspect's clothing to a crime scene.

Example: Detecting parabens on a victim's clothing suggesting contact with a specific shampoo brand.

Practical application: Provides associative evidence when DNA is insufficient.

Challenges: Parabens are ubiquitous, potentially leading to non-specific associations.

#### Patterned Evidence

Concept: Items that exhibit distinctive designs or markings serving as class or individual characteristics.

Related terms: class characteristics, individualization.

Explanation: Includes items such as tire tread, fabric weave, or tool marks.

Example: Matching a specific tire tread pattern to a suspect's vehicle.

Practical application: Helps narrow suspect pools based on unique features.

Challenges: Wear, damage, or environmental exposure can obscure patterns.

#### Photogrammetry

Concept: Technique of deriving measurements from photographs to reconstruct three-dimensional objects.

Related terms: 3D modeling, crime scene reconstruction.

Explanation: Uses overlapping images to create a scaled model of a scene or object.

Example: Reconstructing a blood spatter pattern using photogrammetric software.

Practical application: Allows investigators to visualize and analyze spatial relationships without physical intrusion.

Challenges: Requires high-quality images and calibrated equipment; errors in scaling can affect accuracy.

#### Plasticine Model

Concept: Soft modeling material used to simulate injuries or weapon positions for courtroom demonstration.

Related terms: forensic reconstruction, demonstration evidence.

Explanation: Allows recreation of wound trajectories or bullet paths in a tactile form.

Example: Building a plasticine replica of a skull to illustrate impact location.

Practical application: Enhances juror understanding of complex forensic concepts.

Challenges: Must be scientifically accurate; artistic bias can mislead.

#### Polymerase Chain Reaction (PCR)

Concept: Molecular technique that amplifies specific DNA segments to detectable levels.

Related terms: DNA profiling, STR analysis.

Explanation: Enables analysis of minute or degraded samples by creating many copies of target regions.

Example: Amplifying a STR locus from a touch DNA sample on a door handle.

Practical application: Increases the sensitivity of forensic DNA testing.

Challenges: Contamination can lead to false positives; requires strict laboratory controls.

#### Presumptive Test

Concept: Initial screening assay that indicates the possible presence of a substance, requiring confirmatory analysis.

Related terms: confirmatory test, forensic chemistry.

Explanation: Provides rapid results but may be affected by cross-reactivity.

Example: Using the Kastle-Meyer test to indicate blood, followed by spectrophotometric confirmation.

Practical application: Guides investigators on which samples merit full laboratory work.

Challenges: False positives or negatives can misdirect resources.

#### Probative Value

Concept: The ability of evidence to prove or disprove a fact in question.

Related terms: relevance, admissibility.

Explanation: Evidence with high probative value significantly influences the determination of truth.

Example: A video showing a suspect entering a building has strong probative value for presence.

Practical application: Helps judges decide whether evidence should be admitted.

Challenges: Balancing probative value against potential prejudicial effect.

### Quality Assurance (QA)

Concept: Systematic processes ensuring that forensic work meets established standards.

Related terms: accreditation, standard operating procedures (SOPs).

Explanation: Involves internal audits, proficiency testing, and documentation of procedures.

Example: A lab's QA program includes monthly blind proficiency tests for DNA analysts.

Practical application: Maintains credibility and reliability of forensic results.

Challenges: Continuous updating of standards and resource allocation.

### Rapid DNA

Concept: Automated platforms that generate DNA profiles within hours, often at the point of collection.

Related terms: DNA profiling, field analysis.

Explanation: Integrates extraction, amplification, and detection in a single instrument.

Example: Producing a DNA profile from a cheek swab at a crime scene within 90 minutes.

Practical application: Accelerates suspect identification and reduces backlog.

Challenges: Limited loci compared to full laboratory analysis and higher cost per sample.

### Reference Sample

Concept: Known specimen collected for comparison with unknown evidence.

Related terms: control sample, baseline.

Explanation: Typically obtained from a suspect, victim, or database.

Example: A buccal swab from a suspect used to compare against crime-scene DNA.

Practical application: Provides a direct basis for matching or exclusion.

Challenges: Must be collected under proper chain-of-custody to avoid contestation.

### Rogue Evidence

Concept: Unusual or unexpected items found at a scene that may hold investigative significance.

Related terms: incidental finding, ancillary evidence.

Explanation: Items not directly linked to the primary crime but potentially informative.

Example: Discovering a unique keychain that matches a suspect's known possessions.

Practical application: Can open new investigative leads.

Challenges: Determining relevance without causing bias or contaminating the primary evidence.

### Sample Integrity

Concept: Preservation of an evidence item's original state from collection through analysis.

Related terms: contamination control, evidence preservation.

Explanation: Ensures that the sample's physical, chemical, and biological properties remain unchanged.

Example: Storing a tissue sample at -80°C to prevent enzymatic degradation.

Practical application: Guarantees that analytical results reflect the original condition.

Challenges: Environmental fluctuations and handling errors can compromise integrity.

### Scene Documentation

Concept: Comprehensive recording of a crime scene using photographs, sketches, notes, and video.

Related terms: forensic photography, crime scene reconstruction.

Explanation: Captures spatial relationships, evidence locations, and contextual details.

Example: Taking a 360-degree panoramic photo of a burglary scene.

Practical application: Provides a permanent visual record for later review and courtroom presentation.

Challenges: Time pressure and lighting conditions may limit thorough documentation.

### Serial Number Identification

Concept: Determining the unique identifier assigned by manufacturers to equipment or weapons.

Related terms: firearm identification, trace evidence.

Explanation: Involves locating and recording the number from frames, barrels, or parts.

Example: Matching a recovered rifle's serial number to a purchase receipt.

Practical application: Links a specific item to a suspect or location.

Challenges: Serial numbers may be filed, removed, or defaced, requiring forensic techniques such as acid etching.

### Shotgun Wadding Analysis

Concept: Examination of the plastic or paper material that follows a shotgun projectile to infer distance and weapon characteristics.

Related terms: firearm residue, ballistic pattern.

Explanation: Wadding size, shape, and deformation provide clues about the shot's origin.

Example: Identifying a unique wadding pattern that matches a specific shotgun brand.

Practical application: Helps reconstruct shooting distance and weapon type.

Challenges: Wadding may be destroyed upon impact, limiting recoverable evidence.

### Silhouette Method

Concept: Visual technique for estimating the shape and size of an object based on its outline.

Related terms: forensic sketching, profile analysis.

Explanation: Used when detailed measurements are unavailable, allowing approximate reconstruction.

Example: Sketching a suspect's silhouette from a surveillance image to aid identification.

Practical application: Provides an initial visual aid for investigators.

Challenges: Subjectivity and lack of scale can reduce accuracy.

### Simulated Evidence

Concept: Artificially created items used for training, testing, or proficiency assessment.

Related terms: mock evidence, competency testing.

Explanation: Replicates real evidence characteristics without compromising actual case material.

Example: Fabricating a bloodstain pattern for a forensic training exercise.

Practical application: Enables skill development while preserving authentic evidence.

Challenges: Must closely mimic real conditions to be effective; over-simplification can mislead trainees.

### Skinning Technique

Concept: Method for separating layers of tissue to isolate specific forensic material, such as hair or blood vessels.

Related terms: dissection, forensic pathology.

Explanation: Involves careful incision and removal of targeted structures.

Example: Removing epidermal layers to extract hair follicles for DNA analysis.

Practical application: Allows focused sampling without contaminating surrounding tissue.

Challenges: Requires precision; improper technique can destroy the target material.

### Spatter Analysis

Concept: Study of blood or other fluid droplets to determine origin, angle, and force of impact.

Related terms: bloodstain pattern analysis (BPA), trajectory reconstruction.

Explanation: Uses geometry and physics to interpret patterns on surfaces.

Example: Calculating the angle of impact from an elliptical bloodstain to locate the source.

Practical application: Helps reconstruct events such as assaults or shootings.

Challenges: Complex patterns, overlapping stains, and surface irregularities can complicate interpretation.

### Standard Operating Procedure (SOP)

Concept: Written instructions detailing how specific tasks should be performed to ensure consistency.

Related terms: QA, protocol.

Explanation: Covers collection, preservation, documentation, and analysis steps.

Example: An SOP for fingerprint dusting outlines the type of powder, application method, and lift technique.

Practical application: Guarantees uniformity across investigators and labs.

Challenges: Updating SOPs to reflect new technology and ensuring all personnel are trained.

### Statistical Significance

Concept: Measure of how unlikely an observed result is due to chance alone.

Related terms: p-value, confidence interval.

Explanation: In forensic context, it quantifies the strength of a match (e.g., DNA profile).

Example: A p-value of 0.000001 indicates a highly significant DNA match.

Practical application: Assists courts in evaluating the weight of scientific evidence.

Challenges: Misinterpretation by non-scientists can lead to overstated conclusions.

### Stratigraphy

Concept: Study of layered deposits to interpret chronological sequence of events.

Related terms: sediment analysis, archaeological context.

Explanation: Applies to outdoor scenes where soil layers reveal timing of disturbances.

Example: Identifying a disturbed soil layer under a victim's body to infer burial timing.

Practical application: Provides temporal context for scene reconstruction.

Challenges: Natural processes like erosion can blur layer boundaries.

### Surface Swab

Concept: Small absorbent material used to collect trace material from a surface.

Related terms: cotton swab, evidence collection kit.

Explanation: Rotated across an area to pick up DNA, fibers, or residues.

Example: Swabbing a doorknob for latent fingerprints.

Practical application: Efficient method for gathering minute evidence without damaging the substrate.

Challenges: Inadequate pressure or insufficient coverage may lead to low recovery rates.

### Suspect Interview

Concept: Structured conversation with a person of interest to obtain information relevant to the investigation.

Related terms: interrogation, statement.

Explanation: Conducted following legal safeguards, such as Miranda rights.

Example: Recording a suspect's account of events after a robbery.

Practical application: May yield admissions, alibis, or leads for further evidence collection.

Challenges: Interviewer bias, memory distortion, and legal admissibility concerns.

### Swab Preservation

Concept: Methods for maintaining the stability of biological material collected on a swab.

Related terms: cold chain, transport media.

Explanation: Involves placing swabs in sealed tubes with buffer solution and refrigerating.

Example: Storing a blood swab in a refrigeration unit at 4 °C until analysis.

Practical application: Prevents degradation of DNA or proteins.

Challenges: Delays or temperature fluctuations can compromise the sample.

### Technical Report

Concept: Formal document summarizing forensic findings, methodology, and conclusions.

Related terms: expert report, laboratory report.

Explanation: Provides detailed description of analysis performed, results obtained, and interpretation.

Example: A forensic chemist's report on the composition of an unknown white powder.

Practical application: Serves as evidentiary basis for courtroom testimony.

Challenges: Must be clear, unbiased, and adhere to legal standards for admissibility.

### Temperature Mapping

Concept: Recording temperature distribution across a storage area to ensure consistent conditions.

Related terms: climate-controlled facility, evidence preservation.

Explanation: Uses data loggers placed at multiple points to monitor fluctuations.

Example: Mapping a freezer's temperature to confirm it stayed at -20 °C during evidence storage.

Practical application: Demonstrates compliance with preservation standards.

Challenges: Sensor failures or improper placement can give misleading data.



### Trace Evidence

Concept: Small, often microscopic, material transferred from one object to another during contact.

Related terms: fiber analysis, hair comparison.

Explanation: Includes fibers, hair, glass, paint, and soil particles.

Example: Recovering a single fiber from a victim's clothing that matches the suspect's jacket.

Practical application: Provides associative links when larger evidence is absent.

Challenges: Requires sensitive detection methods and careful handling to avoid loss.

### Transfer Package

Concept: Secure container used to transport evidence between locations while maintaining chain of custody.

Related terms: evidence bag, tamper-evident seal.

Explanation: Often includes insulated compartments, temperature controls, and sealed locks.

Example: A hard-sided case with RFID tracking used to ship a DNA sample to a federal lab.

Practical application: Reduces risk of damage, loss, or tampering during transit.

Challenges: Cost and logistical coordination for specialized packaging.

### Under-Cover Operations

Concept: Covert investigative activities conducted to gather evidence without alerting subjects