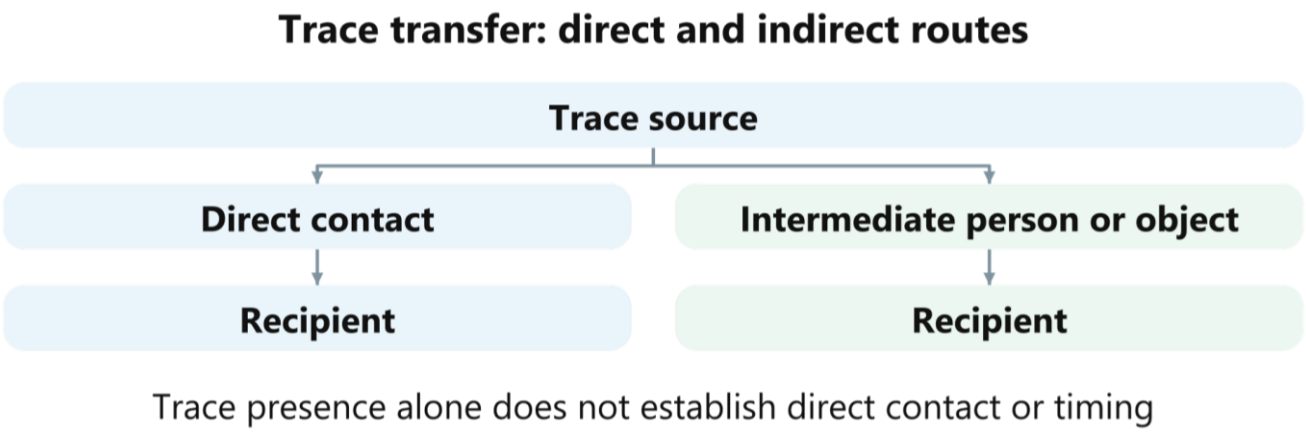
Forensic Medicine and Toxicology - Topic 12 - Forensic laboratory investigation, recent advances and trace evidences

Evidence Transfer and the Laboratory Question

Locard's Exchange Principle



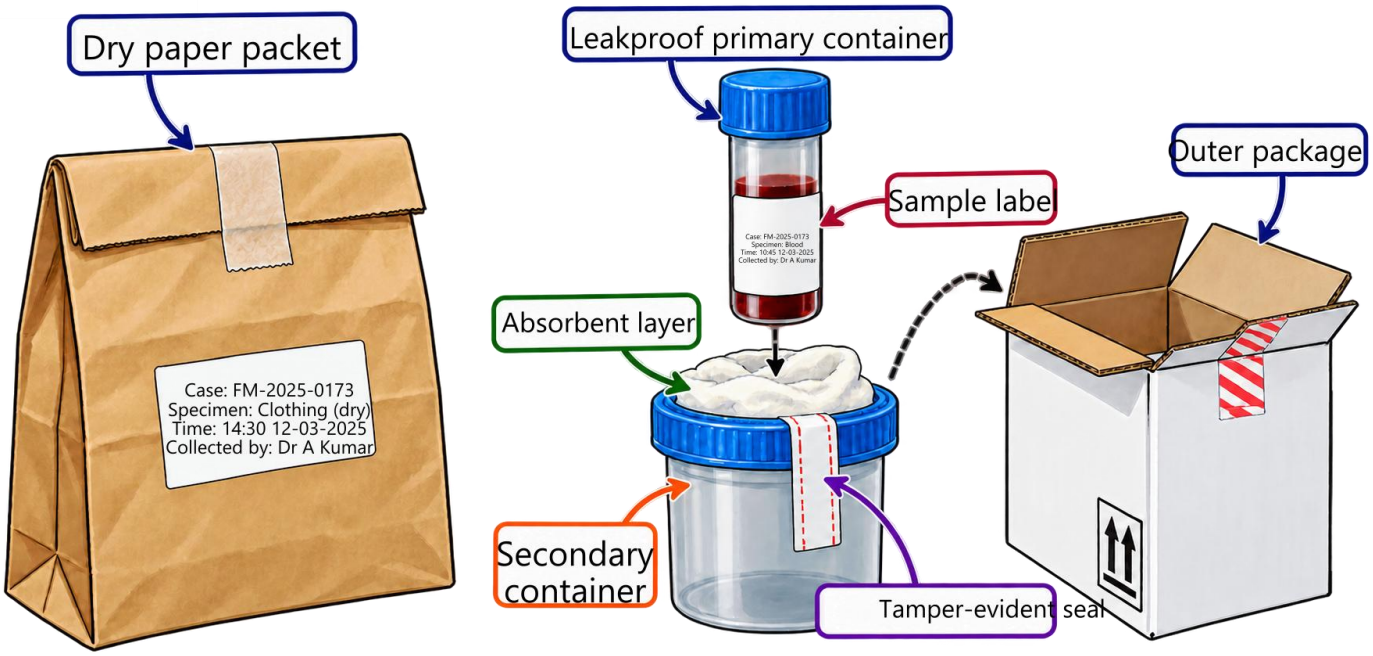
- **Locard's exchange principle** states that contact between persons, objects or places can transfer material between them.
- Transferred material may include biological fluid, hair, fibres, soil, glass, paint or other trace evidence.
- The amount transferred depends on the nature, duration and force of contact and on later activities.
- Material can also be transferred indirectly through an intermediate person or object.
    - Finding a trace therefore does not always establish direct contact or the precise time of transfer.
- Absence of a detectable trace does not prove that contact did not occur.

Selecting a Test

- Before collecting a sample, identify the question that the test is expected to answer.
- For example, a stain may need testing for its biological nature, its species origin, its DNA profile or a suspected toxic substance.
- Different questions may require separate samples, containers and preservatives.
- Consult the receiving laboratory when the suspected substance, specimen or storage requirement is unusual.

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Specimens from Living Persons and the Dead



Separate packaging, labels and seals for forensic evidence

Body Fluids

Blood and Urine

A. Blood

- **Blood** may be collected for toxicology, alcohol measurement, grouping, DNA analysis or clinical investigation according to the case.
- A single tube and preservative should not be assumed suitable for every one of these purposes.

B. Urine

- **Urine** may be useful for toxicology because some drugs or metabolites remain detectable after the blood concentration has fallen.
- A positive urine result does not by itself establish impairment at the time of an event.

Other Body Fluids and Site-specific Swabs

- **Semen and relevant swabs** may provide evidence of biological material and a DNA profile in a sexual-assault investigation.
- **Saliva** may be collected from a suspected stain or as a validated reference DNA sample using the laboratory's method.
- **Faeces** may be relevant to selected poison, infection or trace investigations when the history provides a clear indication.
- A vaginal, anal or oral swab is selected according to the history and examination, not collected indiscriminately from every person.

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Solid Tissues and Trace Material

Skin, Nails, Hair and Skeletal Material

Skin and Nails

- **Skin** may be examined histologically or collected for a specific trace or injury-related question.
- **Nail clippings or scrapings** may retain foreign material, but each hand should be identified and handled to avoid contamination.

Hair and Fibres

- **Hair and fibres** can assist comparison and reconstruction, although visual similarity does not prove a unique source.

Teeth, Bone and Skull

- **Teeth and bone** may provide DNA when soft tissue is degraded, with specialist selection and contamination control.
- Tooth pulp can be useful for DNA, but destructive sampling should preserve necessary dental-identification evidence whenever possible.
- A **skull** may support anthropological assessment or facial approximation when authorised and appropriately documented.

Viscera and Purpose-specific Preservation

- **Viscera** are selected for toxicology according to the suspected poison, clinical course and laboratory requirements.
- Tissue for **histopathology** is usually placed in an appropriate fixative, while samples for toxicology, microbiology or DNA may require entirely different handling.
  - Formalin must not be used routinely for toxicology specimens.

Blood Groups, HLA and DNA

- ABO and Rh typing identify blood-group characteristics and have important clinical uses, but they do not uniquely identify a person.
- **HLA typing** examines highly variable tissue-compatibility markers and may assist selected relationship or transplantation questions.
- Modern forensic identity and parentage work usually relies on validated **DNA profiling** rather than blood groups or HLA alone.

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Collection, Preservation and Chain of Custody

01	02	03	04
Ask focused question	Collect and preserve	Seal and transfer	Interpret in context

Collection and Packaging

Authority and Contamination Control

- Confirm the person's or body's identity, the legal authority and the consent required for the particular collection.
- Use clean or sterile equipment as appropriate and change gloves between samples when contamination is possible.
- Collect questioned and reference samples separately and include controls when the laboratory method requires them.

Packaging and Storage Precautions

- Dry suitable biological swabs and stained clothing before separate paper packaging according to the laboratory protocol.
- Wet evidence must not be sealed in ordinary plastic for prolonged storage because moisture promotes degradation and microbial growth.
- Use leak-proof primary containers, suitable secondary containment and the required transport conditions for fluids and tissues.
- Protect volatile substances from loss and keep samples at the specified temperature without repeatedly opening the container.
- Store sharp or hazardous exhibits safely without altering the trace material or creating a risk to staff.

Match Preservation to the Laboratory Question

A. **Toxicology**
   - Use separate labelled specimens and the receiving laboratory's recommended container, preservative and temperature.
   - Peripheral blood and its precise sampling site are particularly important after death because redistribution affects interpretation.

B. **Histopathology**
   - Routine tissue histology usually requires an appropriate buffered formalin fixative and a labelled tissue container.
   - A separately preserved fresh sample may be needed if infection, chemical analysis or genetic testing is also requested.

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C. DNA and Biological Stains

- Dry appropriate swabs and stained clothing safely before separate packaging under the laboratory protocol.
- Keep reference samples apart from questioned material and change gloves to prevent transfer.

D. Volatile Substances

- Use the specified tightly sealed container with appropriate headspace and temperature control.
- Unnecessary opening can lose a volatile analyte and weaken interpretation.

Labelling, Sealing and Dispatch

Labels, Seals and the Forwarding Note

- Each label should identify the case, individual or body, specimen type and site, date and time, collector and preservative where relevant.
- Use a unique specimen number that agrees with the report and laboratory request.
- Seal the container or package with a tamper-evident method and provide the required specimen seal impression.
- The forwarding note states the relevant history, samples submitted, requested tests and specific questions to be answered.

Transfer Records and Chain of Custody

- Record every transfer with date, time, sender, recipient and condition of the seal.
- Arrange prompt transport by an authorised route and retain the laboratory acknowledgment.
- The **chain of custody** demonstrates continuity of possession and handling, while analytical quality demonstrates reliability of the test itself.

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