EURO4SCIENCE

Exploring science and transdisciplinary learning through forensics

# Beta Version of Toolbox

## Lab Activities

Grant Agreement nr 2014-1-PT01-KA200-001012

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# CONTENTS

- Blood Analysis
- Document Analysis
- Fingerprinting
- DNA profiling
- Polymers on the crime scene
- Forensic Botany



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# BLOOD ANALYSIS

- Bloodstains often constitute the major physical evidence in crime investigation and are frequently found at different sorts of crime scenes.

- In forensic laboratories there are two main types of tests to identify blood: Presumptive tests and Confirmatory tests.

- Presumptive tests: Luminol and Kastle-Meyer Test.



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# BLOOD ANALYSIS

## Presumptive tests

***Educational Content:***

- ✓ Oxidation-reduction Reactions
- ✓ Blood Properties

### Luminol Test

- Reacts with iron found in hemoglobin
- Exhibit a chemiluminescent blue light
- Is used to detect trace amounts of blood left at crime scenes

### Kastle-Meyer Test

- Uses an alkaline phenolphthalin solution to detect the possible presence of hemoglobin
- Phenolphthalein and hydrogen peroxide react with the iron molecules in hemoglobin
- Catalytic color test that will produce a bright pink color



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# BLOOD ANALYSIS

## Activity: Is this really blood?

**Luminol Test**

- Bluestar Forensic kit
- Dark environment
- Spray the specimens with Luminol




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# BLOOD ANALYSIS

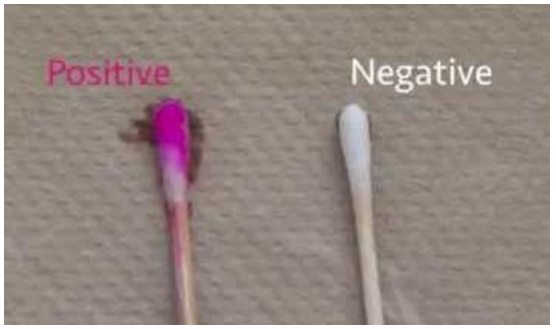
## Activity: Is this really blood?

### Kastle-Meyer Test

***Part 1: Preparation of the Kastle-Meyer Solution***

- Mixture of sodium hydroxide, phenolphthalein and zinc
- The solution is heated until the bright pink turns colourless
- Kastle-Meyer reagent remains usable for several months if stored at room temperature.

***Part 2: Preparation of the Kastle-Meyer Solution***




- A wet cotton swab (ethanol 96%) is rub on the bloodstain
- 3 drops of Kastle-Meyer solution
- 3 drops of hydrogen peroxide



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# BLOOD ANALYSIS

## Blood Typing

***Educational Content:***

- ✓ Antibody – Antigen Reaction
- ✓ Blood Properties

- Blood typing (known as ABO system) is the classification of blood based on the presence or absence of antigenic substances on the surface of red blood cells (erythrocytes).

- Each blood type is also grouped by its Rhesus factor, or Rh factor, that is examined by the presence or absence of the Rh protein.
  - Rh positive (Rh+) – presence of antigens
  - Rh negative (Rh-) – absence of antigens



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# BLOOD ANALYSIS

## Activity: Blood Typing Analysis

**Determination of blood type in the samples:**

- Crime Scene Blood
- Victim Blood
- Four Suspects Blood




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# DOCUMENT ANALYSIS

***Educational Content:***

- ✓ Acidic Properties
- ✓ Chromatography

- Document analysis is the examination and comparison of questioned documents with known material.

- The three main areas of forensic document examination:
  - The identification of individuals through their handwriting
  - Determining whether signatures are genuine or simulations
  - Determining the origin and history of documents
    - » Ink analysis



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# DOCUMENT ANALYSIS

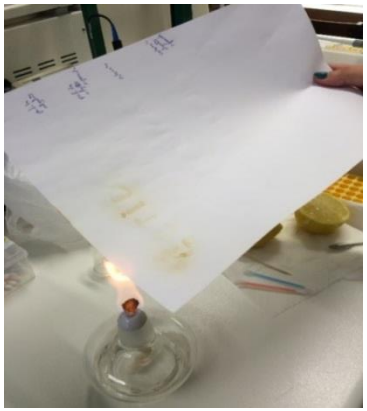
## Activity: Invisible Writing

**Invisible evidence can be revealed by:**

- UV Light


Sunscreen

- Heat



Lemon juice or Milk



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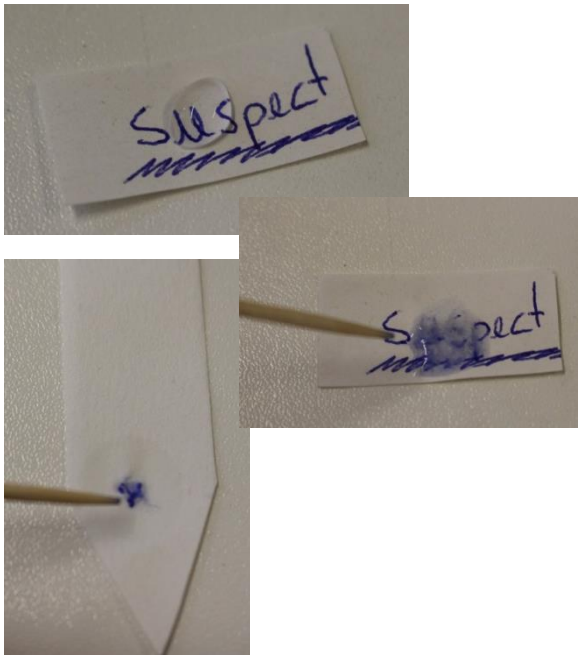
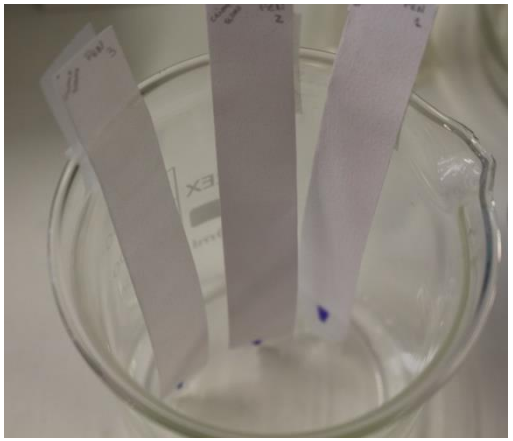
# DOCUMENT ANALYSIS

## Activity: The Colour of Guilt – Chromatography

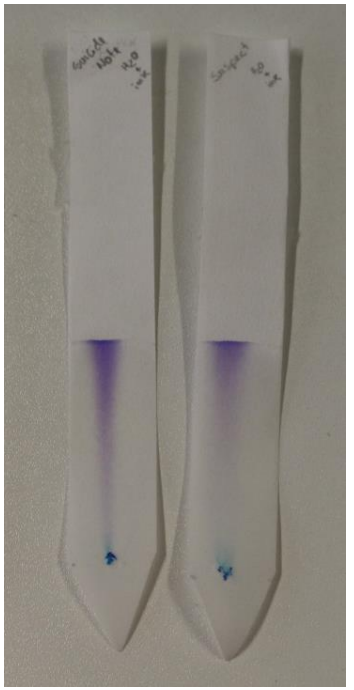
### Distinguish between inks with Thin Layer Chromatography




Transferring the ink



Put in the solvent



Results



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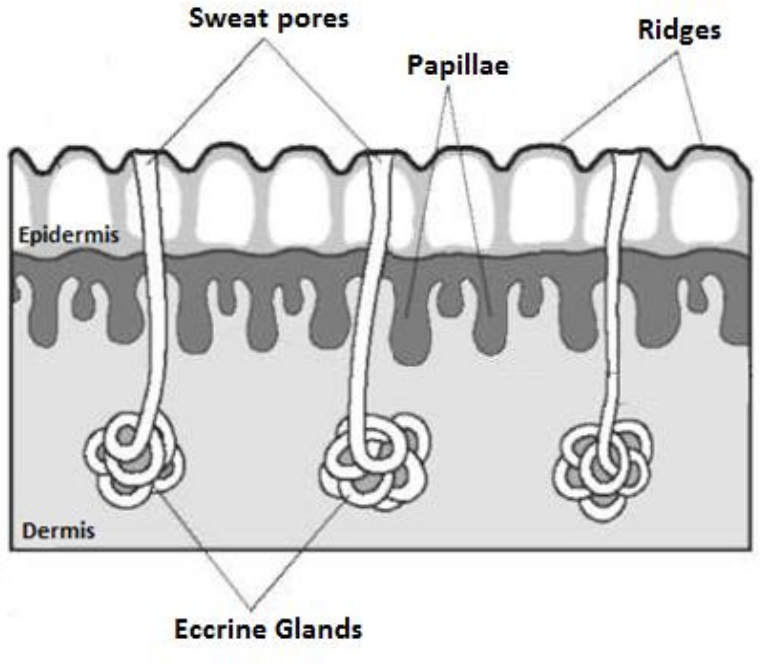
# FINGERPRINTING

- Fingerprints were a major breakthrough in forensic science.
- Fingerprint is an impression left by the dermal ridges.
- The imprint of fingerprint consists of natural secretions of sweat from the eccrine glands.



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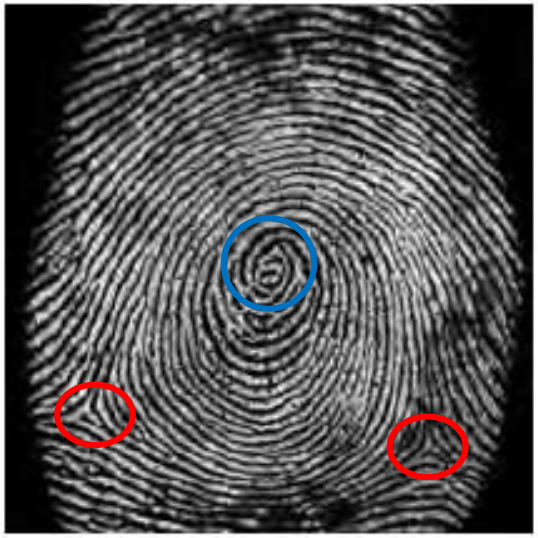
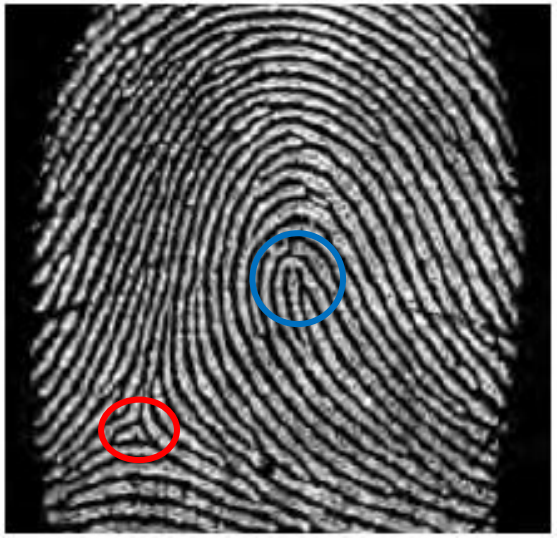
# FINGERPRINTING

## Characteristics of Fingerprints

Arch



Whorls



Loops



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# FINGERPRINTING

## Types of Fingerprints

Patent fingerprints

Plastic fingerprints


Latent fingerprints



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# FINGERPRINTING

## Latent Fingerprints

***Educational Content:***

- ✓ Skin Properties
- ✓ Thermoregulation

### Fingerprint powders

- Used mainly for dusting nonporous surfaces such as glass and polished metal.
- Most commonly used to reveal latent fingerprints on immovable objects at crime scenes.



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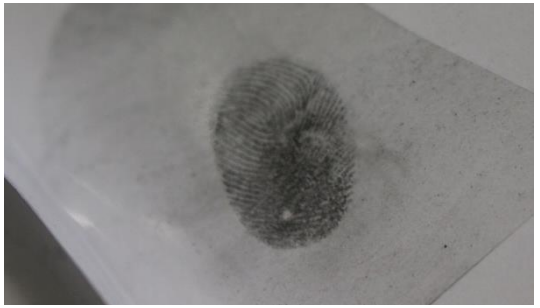
# FINGERPRINTING

## Activity: Dusting and Lifting Latent Fingerprints

**Identify latent fingerprints with graphite powder**

- Put black dusting powder over a glass object
- Use the dusting brush to spin off the powder
- Use adhesive tape to recover the fingerprint





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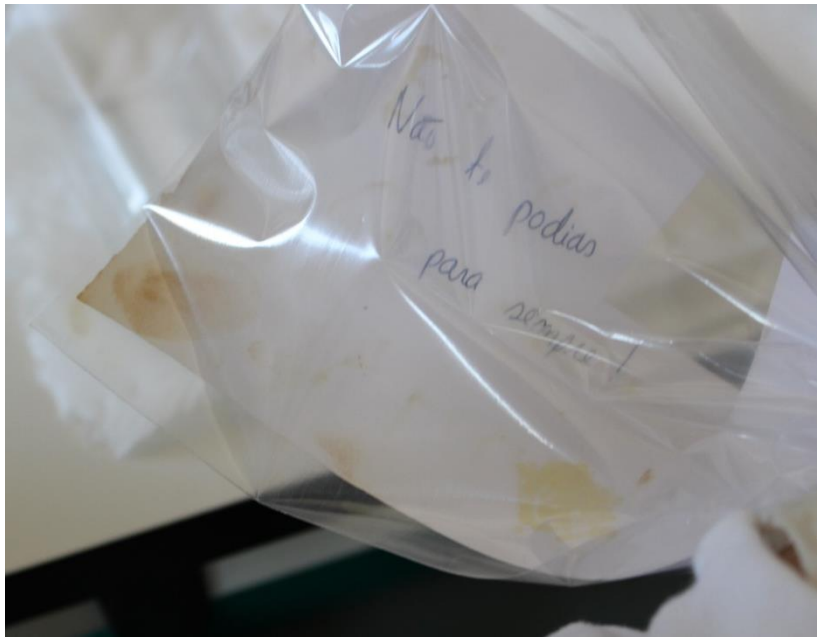
# FINGERPRINTS

## Latent Fingerprints

***Educational Content:***

- ✓ Sublimation reaction
- ✓ Skin Properties

### Iodine Fuming



- One of iodine characteristics is sublimation.
- Used to reveal prints on porous and nonporous surfaces such as paper, index cards, magazines and cardboard.
- This technique is reversible.



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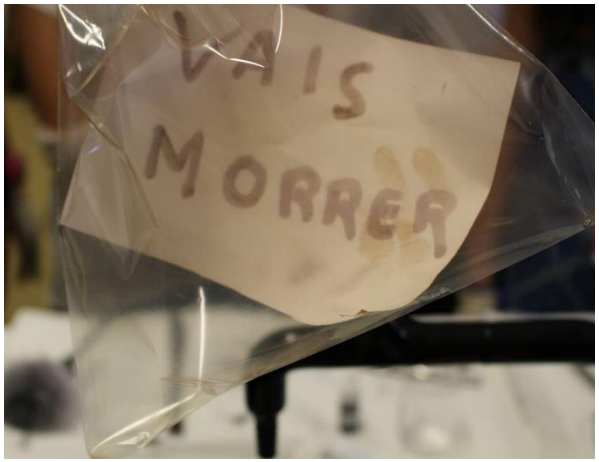
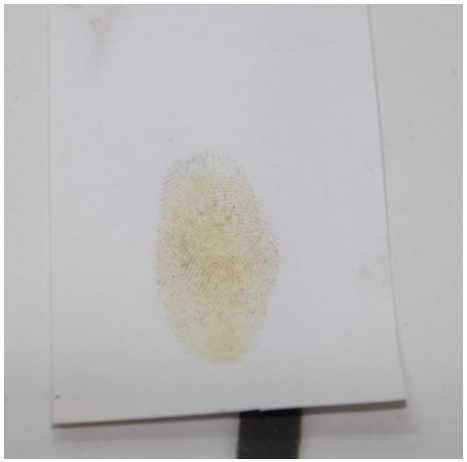
# FINGERPRINTS

## Activity: Revealing Latent Fingerprints using Iodine Fuming

**Identify latent fingerprints with iodine fuming**

- Put 4 tiny iodine crystals to the bag
- Expand the bag so that it contains some air space and the close
- Stir until the fingerprints are revealed





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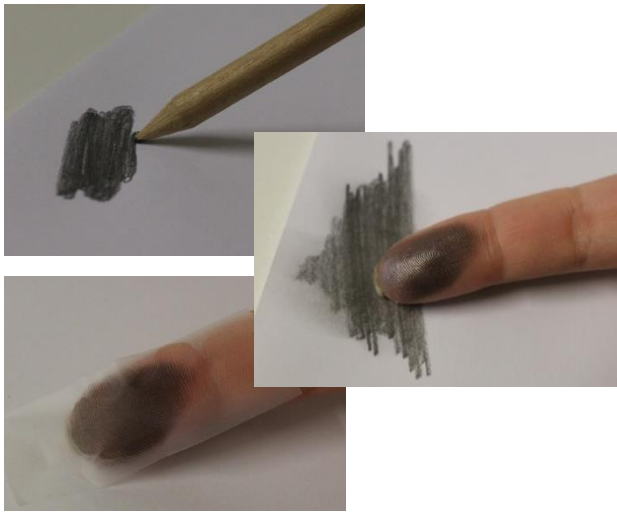
# FINGERPRINTING

## Activity: Study your Fingerprints

### Ink pads

***Part 1: Using pencil to create a graphite pad***

- Rub graphite pencil on a blank white paper
- Rub the finger across the graphite patch
- Collect  fingerprint with adhesive tape



***Part 2: Using a real ink pad***

- Rub the finger across the ink pad
- Press the finger in the identification card



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# DNA PROFILING

- Forensic DNA profiling, or DNA fingerprinting, is a technique to identify individuals by characteristics of their DNA.

- Steps necessary before DNA samples can be analysed and compared:
  - Extract the DNA from the cell nucleus;
  - Amplification of the DNA using polymerase chain reaction (PCR);
  - Electrophoresis.



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# DNA PROFILING

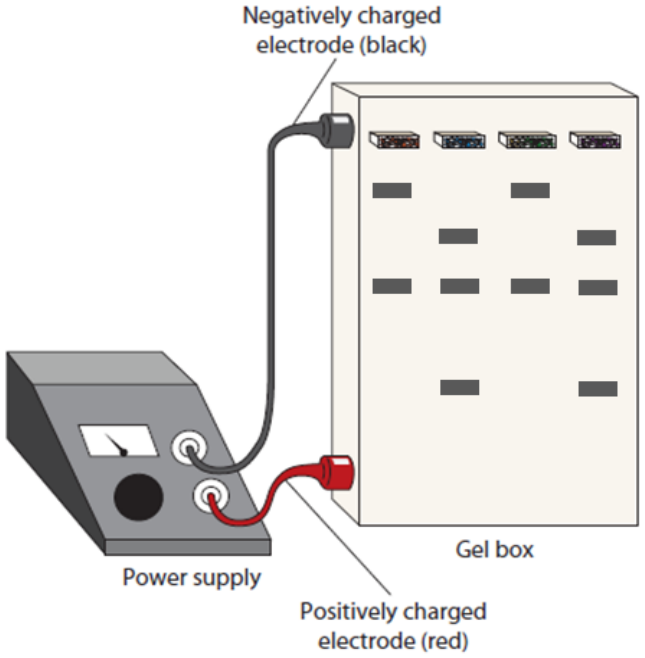
## Electrophoresis

***Educational Content:***

- ✓ Electrical field
- ✓ DNA

- Method of separating the molecules under the influence of an electrical field based on the size of the DNA fragments.

- One of the most known electrophoresis is the gel electrophoresis.
  - Agarose
  - Polyacrylamide



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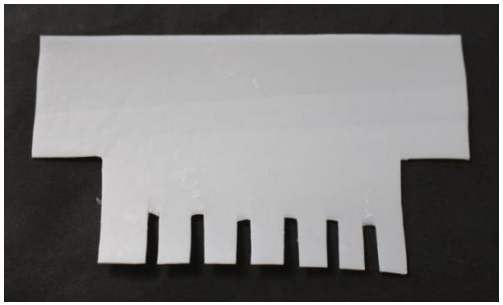
# DNA PROFILING

## Activity: DNA Fingerprinting – Electrophoresis

**Use electrophoresis to compare DNA fingerprints**

- Use butter container to construct the mold for the gel


- Use shampoo package to construct the comb for the gel





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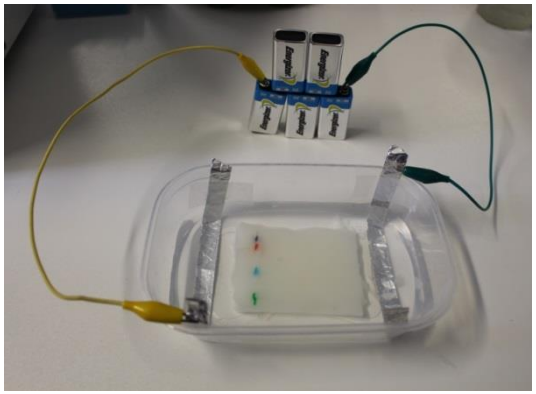
# DNA PROFILING

## Activity: DNA Fingerprinting – Electrophoresis

**Use electrophoresis to compare DNA fingerprints**

- Make the gel with corn starch and the buffer with sodium bicarbonate

- Use 9V batteries as power supply and run the gel





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# POLYMERS ON THE CRIME SCENE

- Document analysis is the examination and comparison of questioned documents with known material and the polymeric material which can be analysed are ink and paper.

- Forensic document examiner use several methods to determine the validity of a questioned document:
  - Examination with an alternate light sources
  - Chemical analysis
  - Microscopic analysis



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# POLYMERS ON THE CRIME SCENE

## Invisible Ink

***Educational Content:***

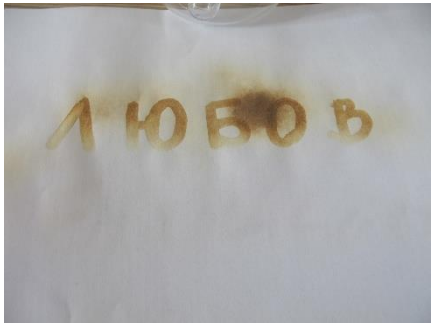
- ✓ Ultraviolet radiation theme
- ✓ Prevention of skin cancer

**Invisible evidence can be revealed by:**

- UV Light

Sunscreen

- Heat



Lemon juice



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# FORENSIC BOTANY

- Forensic Botany is the area of Forensic Sciences that uses plants, seeds or other botanical remains in the solving of crimes or other legal questions.

- The leaves, seeds or pollen found on the body or in a crime scene can provide important information regarding the date of the crime, relate a crime suspect with a location or, for example, evaluate if a body was moved between two or more different locations.

# FORENSIC BOTANY

## Activity: Forensic Palynology – The pollen investigation

### Observation of pollen through a microscope

*Erica umbellata*

*Pinus pinaster*

*Lavatera cretica*



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# FORENSIC BOTANY

## Activity: Forensic Palynology – The pollen investigation

### Observation of pollen through a microscope

**Family:** Pinaceae

**Common name:** Maritime Pine

**Habitat:** Coastal sands and dunes, it is also found on mountains inland

**Pollen:** monad with two separate sacs which facilitate dispersal



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Thank you for your attention!



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