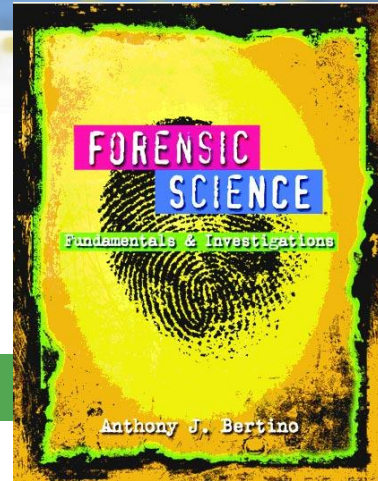


Chapter 5

Pollen and Spore Examination

By the end of this chapter you will be able to:



- Distinguish between pollen and spores
- Define a pollen fingerprint
- Classify the different organisms that produce pollen and spores
- Compare and contrast the female and male reproductive parts in plants
- Distinguish between gymnosperms and angiosperms

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Chapter 5

Pollen and Spore Examination

By the end of this chapter you will be able to:

- Summarize the different methods of pollination and their relevance in solving crimes
- Identify the different ways spores are dispersed
- State characteristics of pollen and spores that are important for forensic studies
- Summarize how pollen and spore evidence is collected at a crime scene
- Describe how pollen and spore samples are analyzed and evaluated



Introduction

Forensic palynology—a specialized field that studies pollen and spore evidence

- Pollen and spores are microscopic reproductive structure that have resistant structures
- Pollen—contains the male gametes of seed plants
- Spores—found in certain protists, algae, plants and fungi



Introduction

- Pollen and spore analysis entails Locard's Principle of Exchange
- Pollen and spores can help determine:
 - whether a body was moved
 - a crime's location—in a city or in the country
 - the season



Pollen-Producing Plants

Pollen fingerprint—the number and type of pollen grains found in a geographic area at a particular time of year

Non-seed plants

- ferns, mosses, liverworts, and horsetails

Seed plants

- gymnosperms (cycads, ginkgoes, and conifers)
- angiosperms (flowering plants)



Gymnosperms

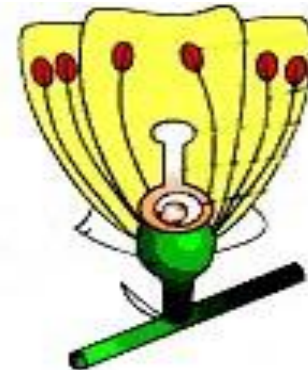
- Gymnosperms are the oldest seed plants
- Conifers are the largest group
- Seeds are contained in hard, scaly structures called cones
- The male cones pollinate the female cones
- Which cone is female and which is male?





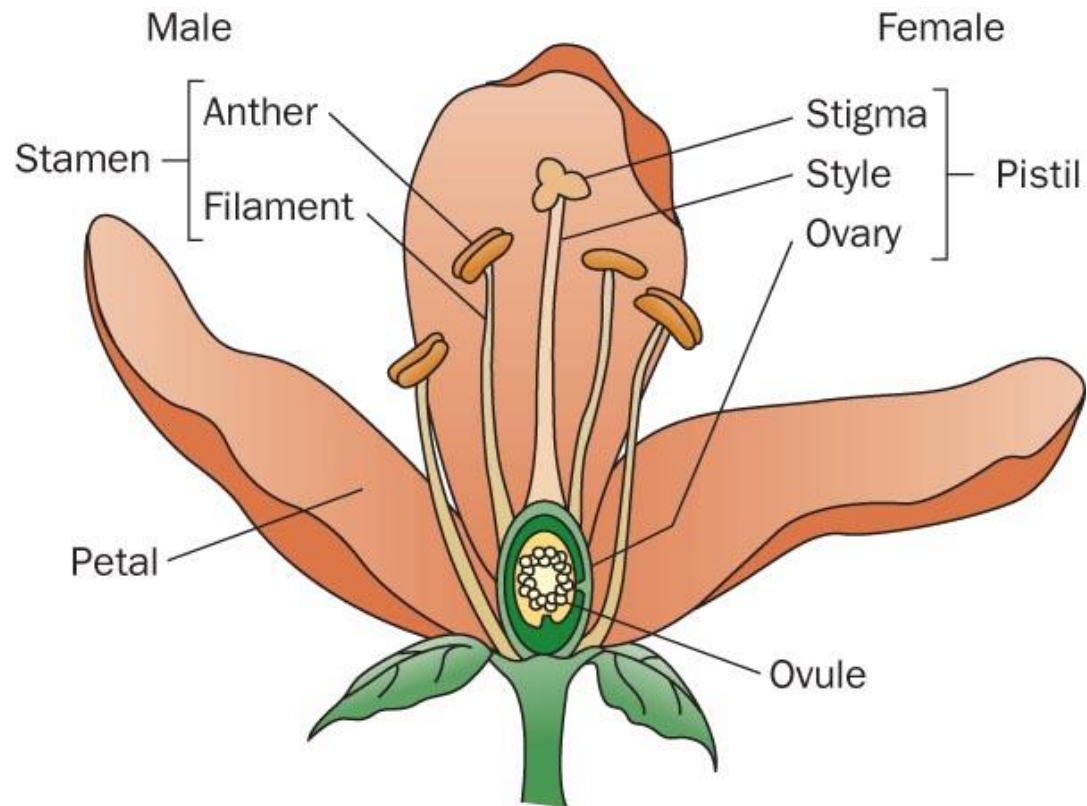
Angiosperms —Flowering Plants

- The most recent plant group to evolve
- Produce seeds in an enclosed fruit
- Very diverse group
(includes corn, oaks, maples, and the grasses)
- Pistil—female part
- Stamen—male part
- Identify the parts in this illustration





Angiosperms —Flowering Plants



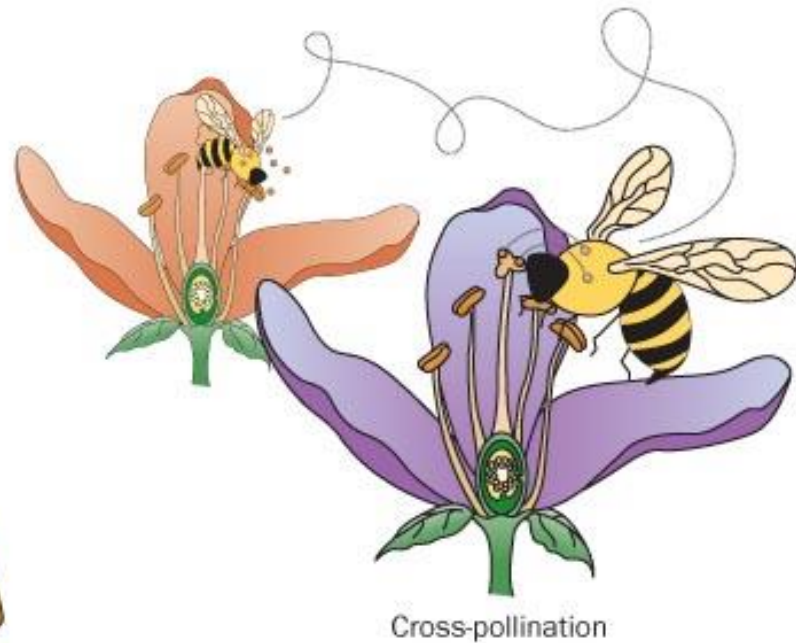
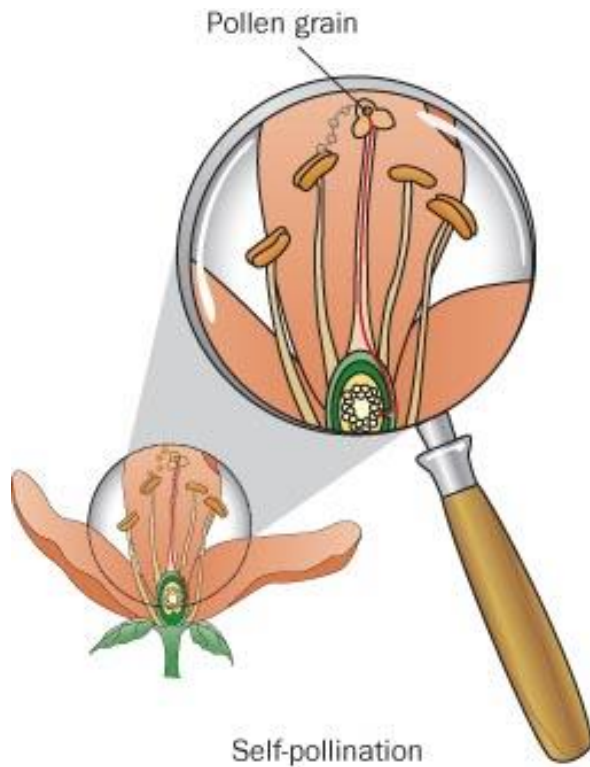


Types of Pollination

- **Pollination**—the transfer of pollen from the male part of a plant to the female part of a seed plant
- **Self-pollination**—pollen transfers from an anther to the stigma within the same flower, as in pea plants
- **Cross-pollination**—pollen transfers between two distinct plants



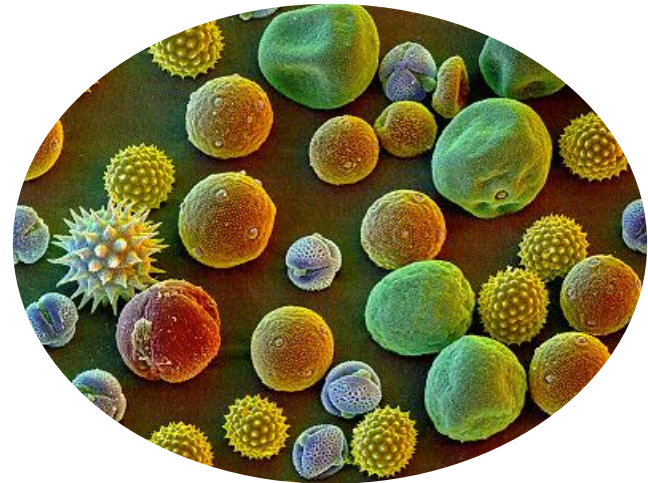
Types of Pollination





Types of Pollination

- Pollen of self-pollinating plants
 - Rarely encountered
 - Lower value in forensic studies
- Pollen can be carried by
 - Wind
 - Animals
 - Water
- Wind-born pollen is less effective
 - Potentially long distances





Spore Producers

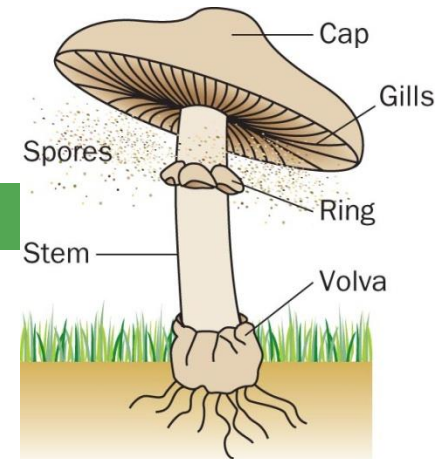
- Spore producers include
 - Certain protists (algae)
 - Plants
 - Fungi
 - Bacteria
- Bacterial spores, endospores include diseases such as anthrax and botulism
- Spore advantages
 - Spores can be grown to increase sample size
 - Identifiable with certainty



Spore Dispersal



- o Algae disperse spores into water or air
- o Potentially large dispersal range reduces value in investigations
- o Explain how mushroom spores are released into the wind

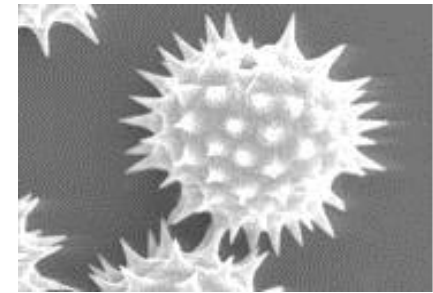


Pollen and Spore Identification in Solving Crimes



Angiosperm
pollen grains

Gymnosperm
pollen grains



Exine

- Outer shell of a pollen grain and spore
- Microscopes reveal complex and unique structures
- Identification provides potential trace



Finding Pollen and Spores

Common Sources of Pollen and Spore Evidence
Living and decaying plant material
Soil, dirt, mud, and dust
Hair, fur, and feathers
Clothing, shoes, blankets, rugs, baskets, carpet, and rope
Victim skin, hair, nails, nasal passages, lungs, stomach, intestines, and fecal material
Paper, money, and packaging material (newspaper, straw, cardboard, plastic)
Vehicles
Furniture
Air filters of cars, homes, airplanes
Cracks and crevices in floors, walls, roofs, and fences
Drug resins
Honey and other food



Collecting Pollen and Spores

- Control and evidence samples must be collected
- When collecting samples:
 - Wear gloves
 - Use clean tools
 - Place in sterile containers, sealed and labeled
 - Secure and establish a chain of custody
- Sampling instruments must be clean or new



Evidence Collection

Gather large concentrations of pollen in paper bindles using forceps or a dry paintbrush.

Use adhesive tape on clothing to lift trace amounts of pollen from clothing or other surfaces.

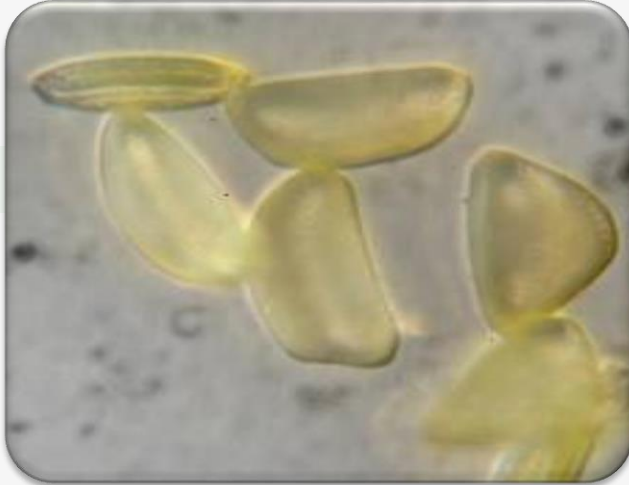
Secure all evidence in labeled, sealed containers for transport to the lab.



Analyzing Pollen and Spore Samples

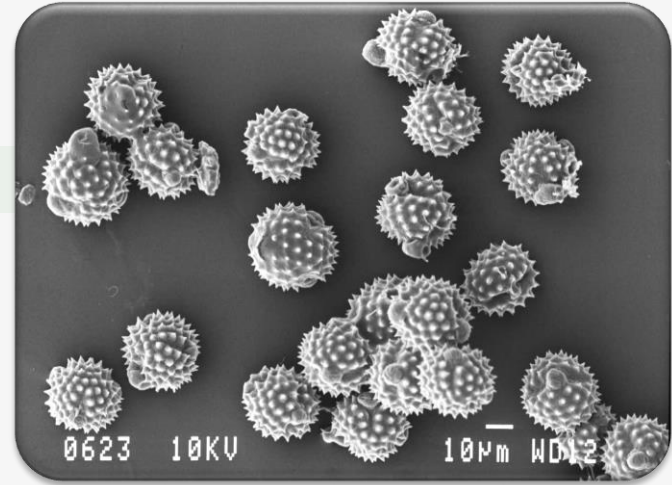
- Pollen and spores are chemically extracted from samples
- Tools specialists use to examine and identify include:
 - compound light microscope
 - scanning electronic microscope (SEM)
 - reference collections
(photos, illustrations, dried specimens)
- Pollen and spore evidence—collected, analyzed, and interpreted—can be presented in court

Analysis - Tools



Compound light microscope

- Needs X1000 or greater magnification
- Can identify plant **family** or **genus**



Scanning Electron Microscope (SEM)

- Up to X100,000 magnification
- Can identify **species** of plant



Plant Evidence

- Chlorophyll can sometimes be extracted from leaves.
- Different plants contain different types of chlorophyll, so it can be forensically valuable.
- Chromatography techniques can reveal the chlorophyll bands.



..... Summary

- Forensic palynology can indicate something about the geographic origin and the time or season of a crime.
- Spores and pollen can be dispersed by wind, by water, or by animals.
- Pollen from insect-pollinated plants tends to give more specific location data than from wind-pollinated plants.



Summary

- Pollen collected at a crime scene must include baseline samples from the area for comparison.
- Collection of pollen and spore evidence must be performed carefully to avoid contamination.