

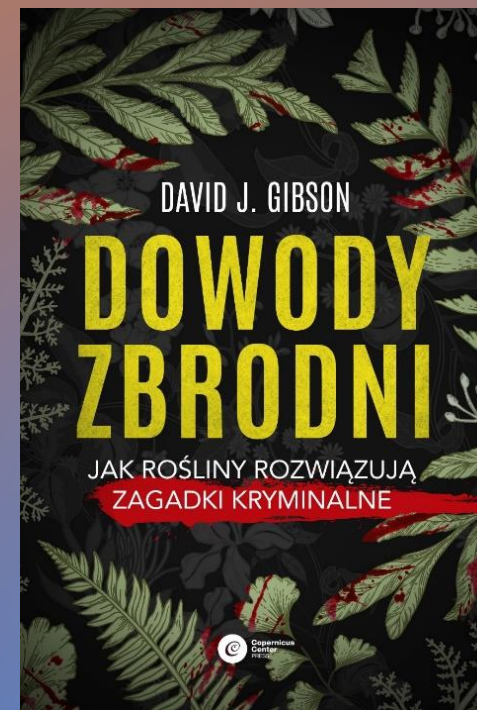
Planting Clues: How Plants Solve Crimes

David Gibson
February 8th 2024



Shawnee Group





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Botanical Evidence in Legal Investigations

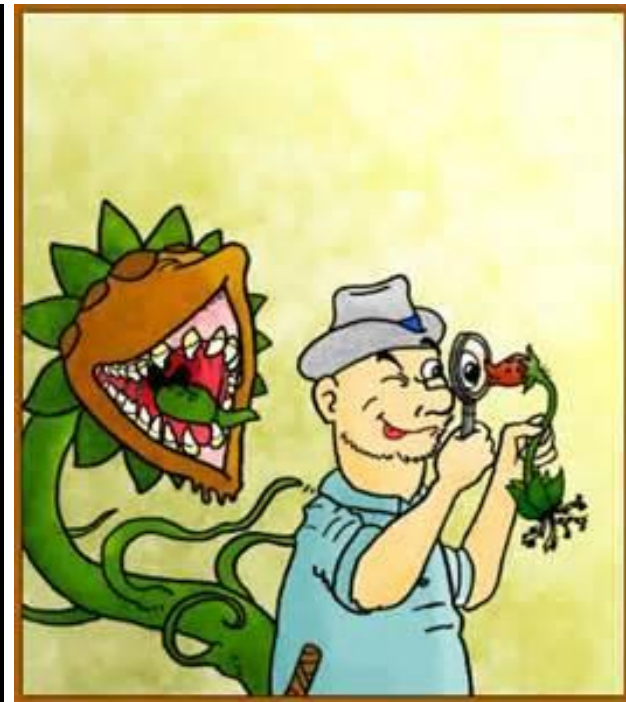
- Crimes against persons
- Prohibitions on growing, selling, transport of certain plants
 - Illegal drugs
 - Exotic plants
 - Noxious weeds
 - Rare plant poaching
 - Biofuel escapes
 - Planting prohibited GM crops



Ginseng

Botanical Evidence in Legal Investigations

- Evidence must be interpreted by a botanist: **Expert Witness**
- Botanical specialties
 - Systematics
 - Anatomy
 - Morphology
 - Palynology
 - Ecology
 - Physiology
 - Chemistry
 - Genetics
- Identification of whole plants/fragments/seeds/DNA
- Plant Blindness



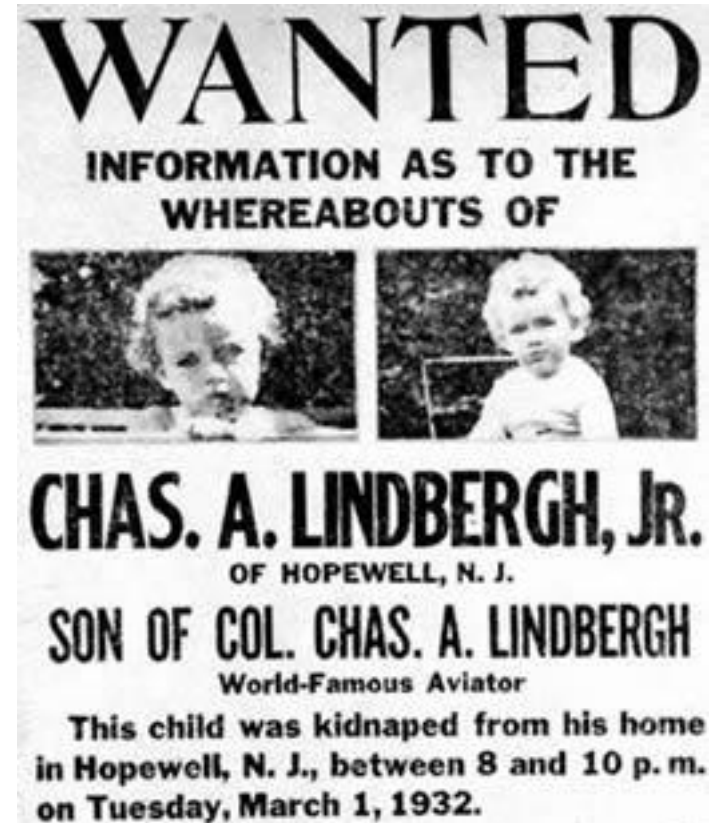
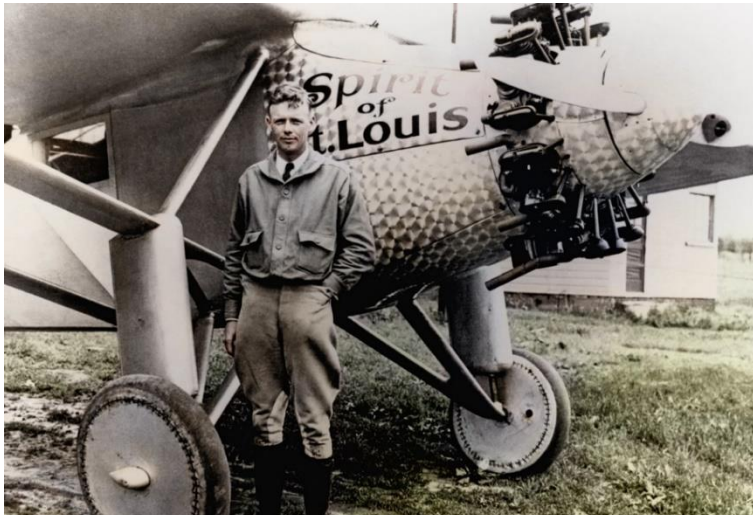
Famous Cases

- Casey & Caylee Anthony
- Ted Bundy
- Baby Lindbergh case
- Maricopa case



1: Lindbergh Kidnapping

- Child kidnapping
- Celebrity parents
- Wood evidence
- Precedent for introduction of botanical evidence into court



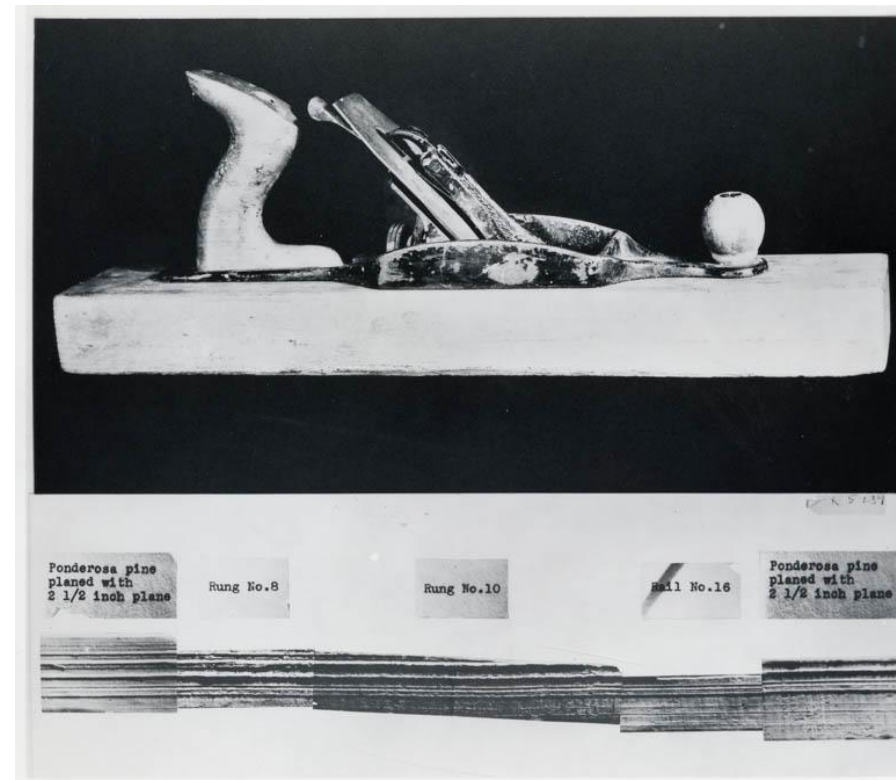


Wooden ladder – key evidence

- Suspect: Bruno Hauptmann
- 34 yr old carpenter
- Caught passing marked ransom bills
- Handwriting match

Arthur Koehler (USFS) – expert witness

- Yellow pine, ponderosa pine, Douglas fir, birch
- Saw marks matched sawmill where suspect worked
- Ladder rail matched missing boards in attic of suspect (position, shape, growth rings)
- Saw cut width matched saws in tool chest



Outcome

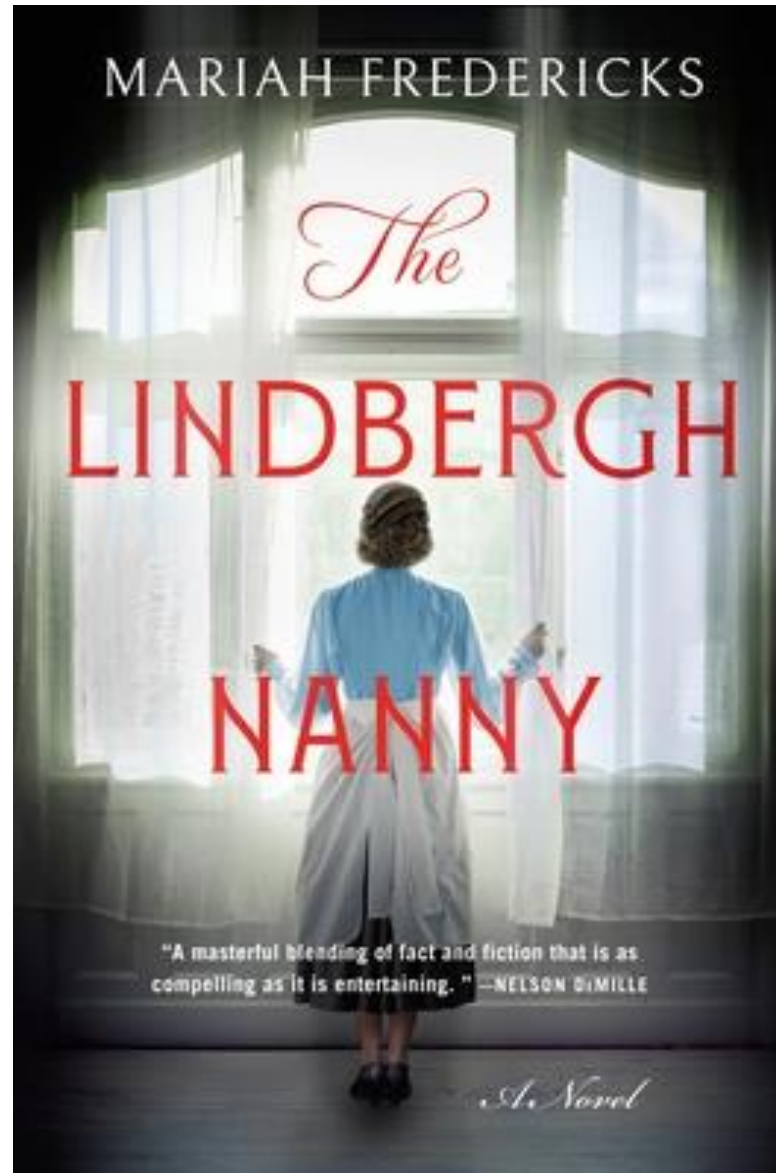
Hauptman – guilty –
electric chair

Introduction of botanical
evidence in trial

Lindbergh Kidnapping
Law (1934)

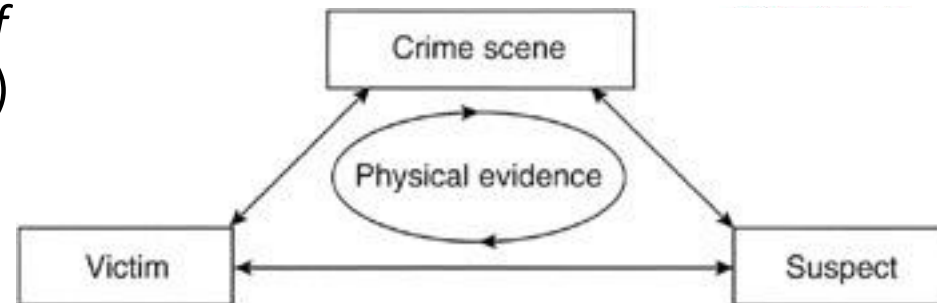
Cross state line during
kidnapping → federal
crime → death penalty
eligible





2: Locard's Exchange Principle

- Edmond Locard 1877-1966
- Founder of Forensic Science
- 1st police laboratory, Lyon France 1910
- *“The truth is that none can act with the intensity induced by criminal activities without leaving multiple traces of his path....”* («sans laisser des marques multiples de son passage »)
- *“...Sometimes the perpetrator leaves traces at a scene by their actions; sometimes, alternatively, he/she picked up on their clothes or their body traces of their location or presence.”* (Locard 1920)



3: Plant Fragments

- Botanical evidence can undermine an alibi
- Latin *alibi* “somewhere else”
- Link object / person to crime scene
- Track victims / suspects

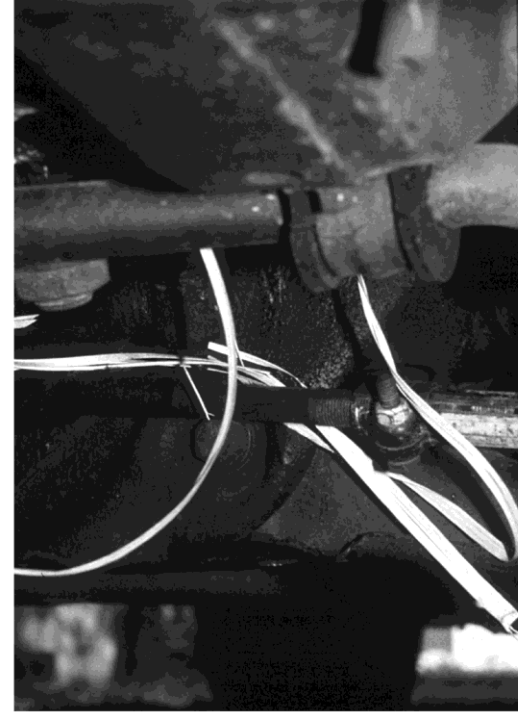
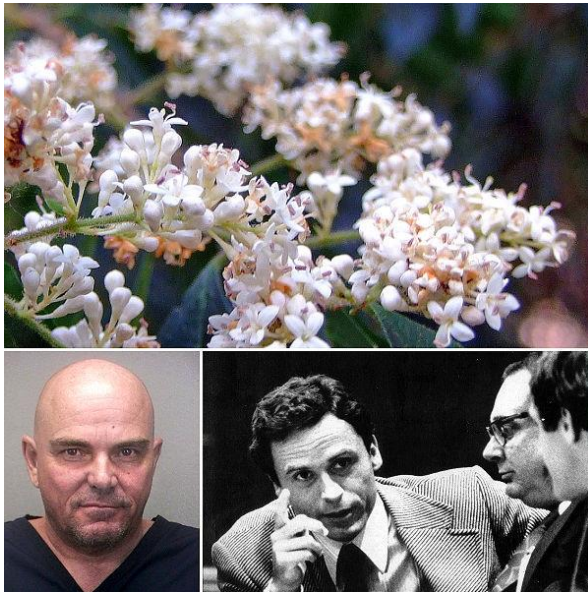


Figure 1.5 Vegetation found on suspension under suspect vehicle. (Courtesy of Dr J. H. Byrd.)

Florida law enforcement relied on forensic botany in cases like Jamie Saffron, left, and serial killer Ted Bundy.

Timing

- When an event occurred
 - Phenology
 - Annuals – distinct season
 - Amount of wilt
 - Sap accumulation
 - Chlorophyll degradation
- Post-mortem interval (PMI)
 - Tree rings
 - Growth rates

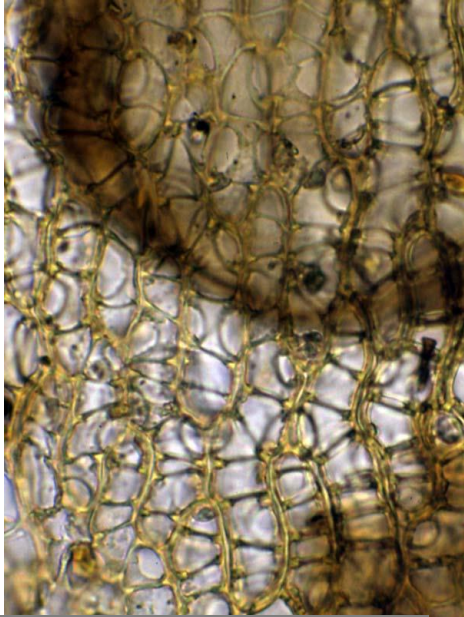


Moss Evidence

- People v. Charles Michael Ashley, No. 87-CF-9. Crawford Co., IL
- Defendant
 - Charles Michael Ashley;
 - Multiple counts of murder and arson;
 - Feb 1, 1987; Robinson, IL
- Victims
 - Melinda D. Buchanan, (age 24)
 - daughters, Jennifer (age 2) and Rachael (age 4)
- Expert Witness: Dr. Barbara Crandall-Stotler, SIUC, Bryologist



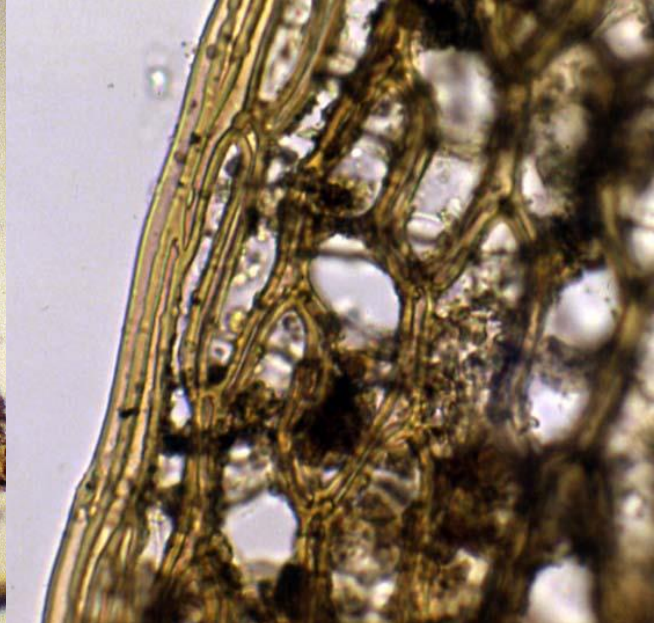
Botanical Material in the Exhibits



Victim's finger nails



victim's clothing



Defendant's coat in bedroom



Defendant's bandana in his truck

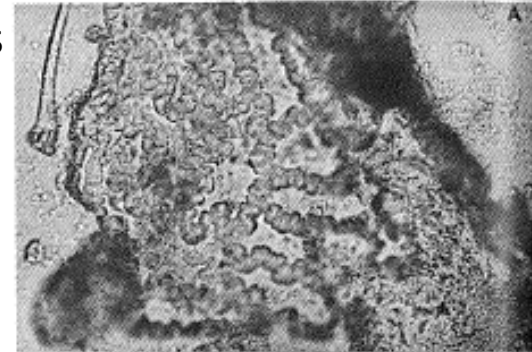
- All leaves are bordered, with elongate hyaline cells with fibrils and pores
- What are they? **Sphagnum**
- Linked suspect to crime scene.
- Found guilty on September 11, sentenced to life in prison

Stomach & Intestinal Contents

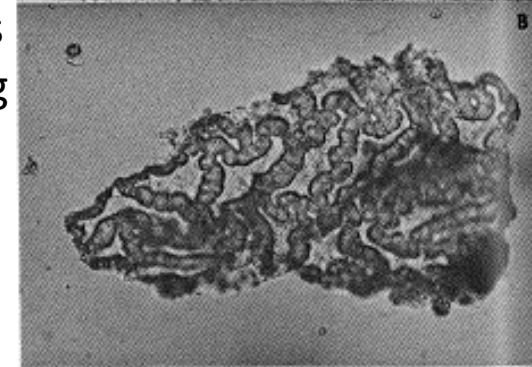
- Identification of stomach contents or feces
 - Anatomical investigation
- Link victims to killers
- Location of last meal
- PMI
- Ingestion of toxic plants
- Drug abuse
 - Chemical analysis

Raped, murdered young woman

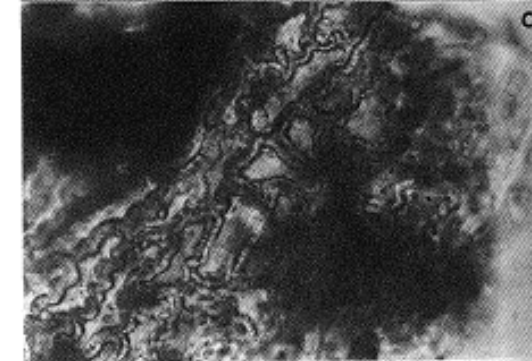
Victim's
fecal
sample



Victim's
clothing



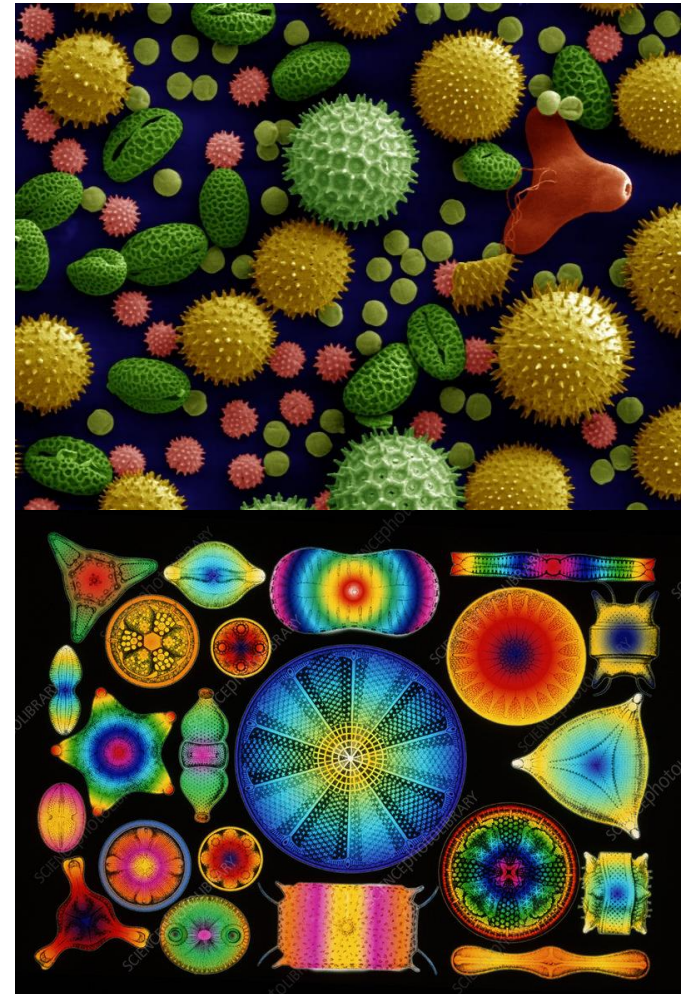
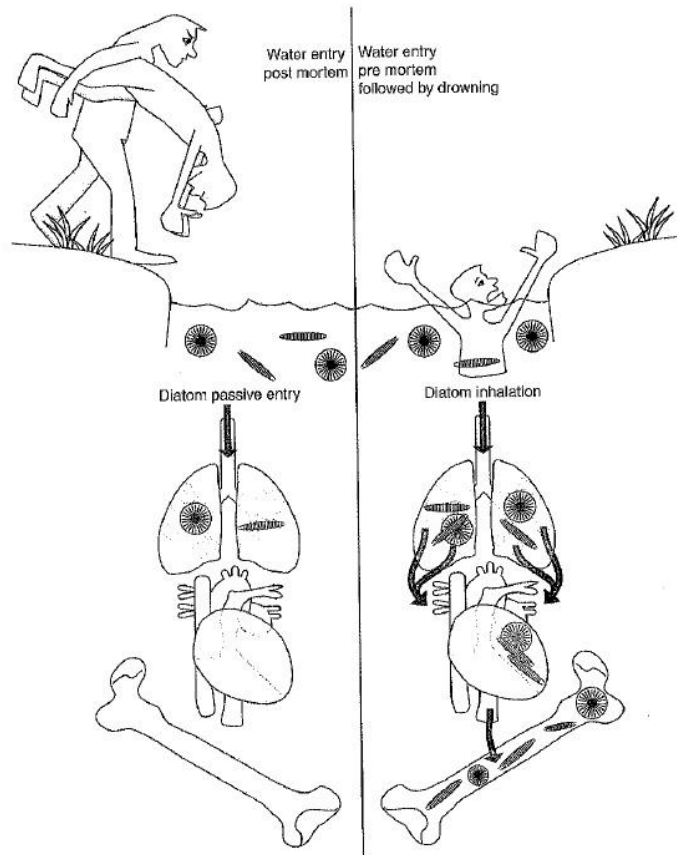
Suspect's
clothing



Pepper seed coat

4: Seeds, Spores, Pollen, & Diatoms

- Diagnosis and placing of death by drowning from diatom presence



Murder in the Hudson River

- May 1996 58 yr old woman pulled from Hudson River, NY
- Neck wounds – strangulation
- Blood – diphenhydramine – drugging
- Femoral bone marrow – diatoms – drowning
- River water diatoms – same as in bone
- Dumped shoes, watch, wallet – same diatoms
- Suspect: 63 yr old live-in boyfriend
- Nephew – accomplice – testified against suspect
- Drugged – dumped in river – regained consciousness – strangled as she drowned.



5: DNA

- 1st use of plant DNA evidence 1992
- Maricopa, Arizona
- Denise Johnson's body found in brush at abandoned factory
- Pager ID suspect Mark Bogan.
- Seed pods of Palo-Verde tree (*Cercidium* sp.)
 - Crime scene
 - Bed of suspect's pick-up
- RAPD analysis – match with tree near body
 - 18 trees outside crime scene different
- Murder conviction
- Established admissibility of plant DNA evidence

Guilty !

FORENSIC SCIENCE

Botanical Witness for the Prosecution


Sometime late on the night of 2 May 1992, a woman was killed and her body abandoned in the Arizona desert. A beeper, found near the body, pointed police to the man now on trial for the murder. But the key piece of evidence may be something far subtler and more scientific: DNA sequences from a few seed pods found rattling around the back of the same man's truck. In April of this year, Judge Susan Bolton of the Superior Court of Arizona's Maricopa County ruled that DNA profiles linking the seed pods to a Palo Verde tree near where the body was found could be admitted as evidence in the murder trial.

Bolton's decision appears to mark a scientific and judicial first. Although DNA profiles from samples of human tissue are widely used in criminal trials for rape and murder, the Maricopa case appears to be the first use of plant DNA in a criminal case. Those following the status of DNA profiles in the courtroom say the decision is a sign that additional novel applications of the technique are likely to appear as investigators become more aware of its possibilities and begin looking for other kinds of biological evidence from which DNA can be extracted.

When the Maricopa County Sheriff's office first asked molecular geneticist Tim Helentjaris of the University of Arizona, Tucson, to look into the possibility of using DNA profiles to try to match the seed pods in the defendant's truck to an individual specimen of the Palo Verde tree—a bizarre, often leafless tree that can photosynthesize through its branches—at the crime scene, Helentjaris replied that he wasn't sure the job could be done. For one thing, he didn't know whether he could get enough DNA for the analysis from the seed pods. And he also worried that the plants wouldn't have sufficient genetic variability to identify an individual through its DNA profile. But as he pursued his research, Helentjaris learned that Palo Verde trees show a high degree of genetic variation—which made it possible for the pods to take the stand in the trial.

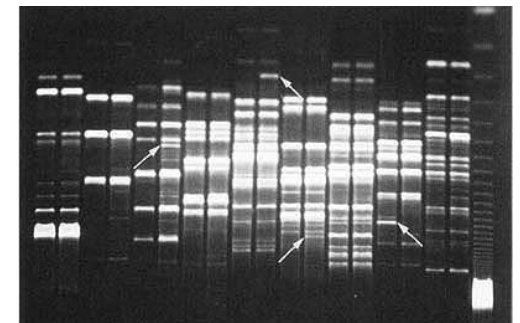
Helentjaris, whose lab has been mapping plant genomes, analyzed the Palo Verde DNA with a technique known as Randomly Amplified Polymorphic DNA, or RAPD, a technique involving the PCR gene amplification method. RAPD uses generic DNA primers that contain as few as 10 bases and thus bind to many sites in the genome. Under the proper binding conditions, each primer produces a reproducible profile of amplified fragments. Helentjaris says that by using multiple

DOUG BOWLING/ARIZONA COURIER



Rugged individual. Palo Verde trees show a lot of genetic variation.

SCIENCE • VOL. 262 • 14 MAY 1993



6: Poisons



Socrates, 399 BCE

“I have heard that one should die in silence. Keep quiet and be brave.”

Conium maculatum – poison hemlock

Coniine - alkaloid



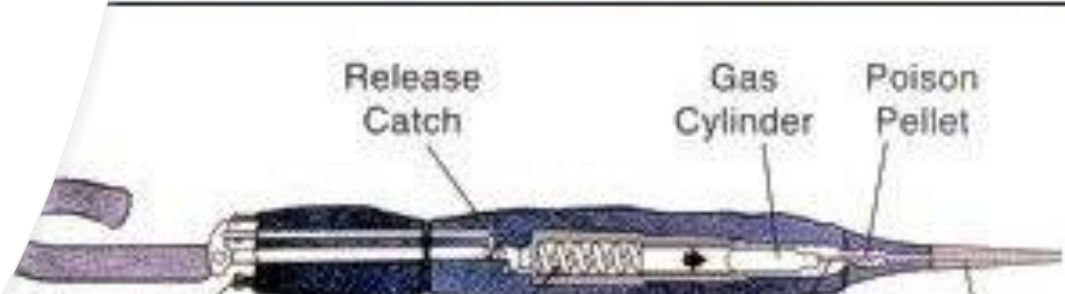
Strychnine

- *Strychnos nux-vomica*
- Terpene alkaloid
- Rodenticide, adulterated street heroin
- Opisthotonos spasms, rictus grin, death
- Alexander the Great – 323 BC
- Jane Stanford - 1905
- Robert John (blues legend) - 1938
- Turgut Özal, President of Turkey, 2012
- Sue Morency – 1990, wife of NFL John Morency
- Alexander Perepilichnyy – 2012 - Russian whistleblower, Putin critic
- 94 cases reported to French PCC since 2008



Ricin

- *Ricinus communis* – castor oil plant
- Glycoprotein lectin
- Inhibits protein synthesis
- Letters to politicians
- ‘Umbrella assassination’
 - 1978
 - Georgi Markov



7: Poaching



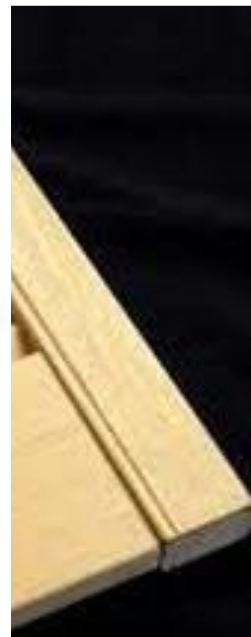
- **Convention on International Trade in Endangered Species of Wild Fauna and Flora = 'Washington Convention'**
 - 1975
 - 169 countries signatories
 - 30,000 plants (70% orchids), 5,800 animals
 - Appendix I
 - 7 orchid spp., 2 orchid genera
 - No export/import unless artificially propagated
 - Appendix II
 - Entire Orchidaceae (870 genera, 25,000 spp.)
 - Official permits required for movement across borders



- **Police catch Costa Rica orchid thief red-handed**
 - The Tico Times, March 21, 2015

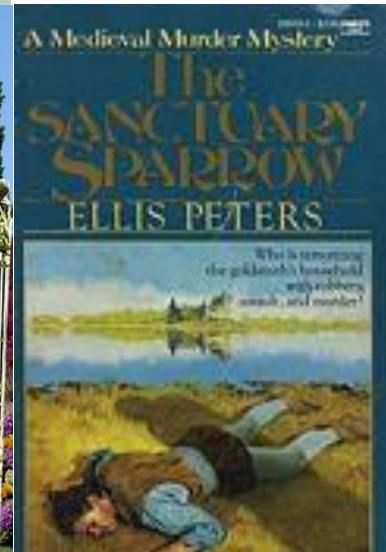
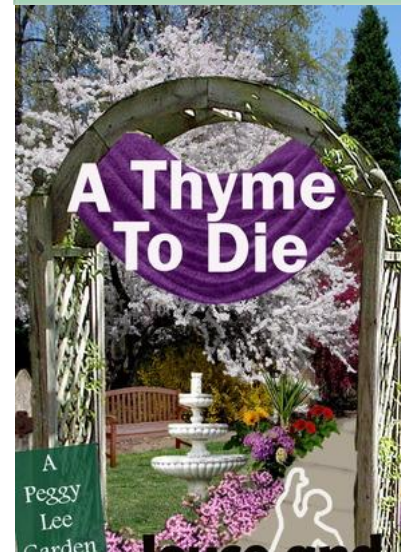
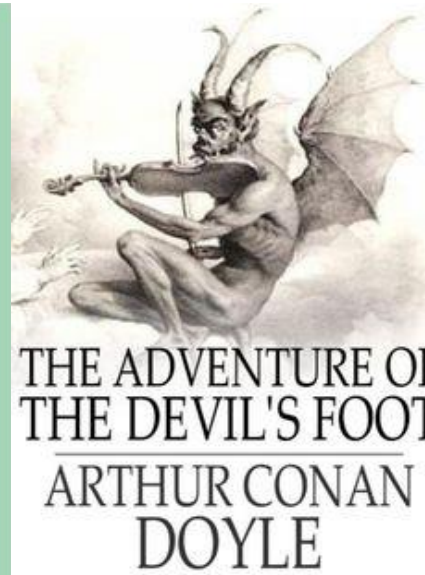
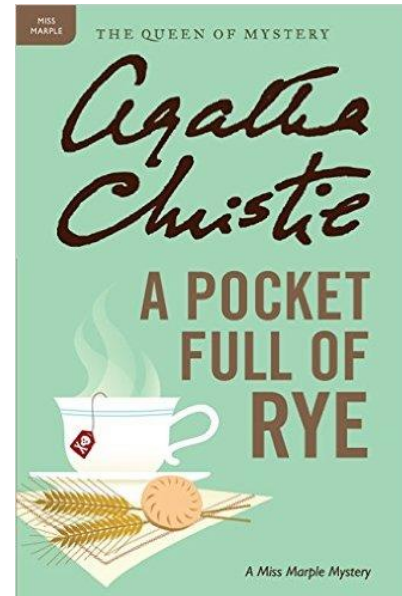
Tropical
Ramin
sp.), I
(*Dalbergia*
pterocarpoides)

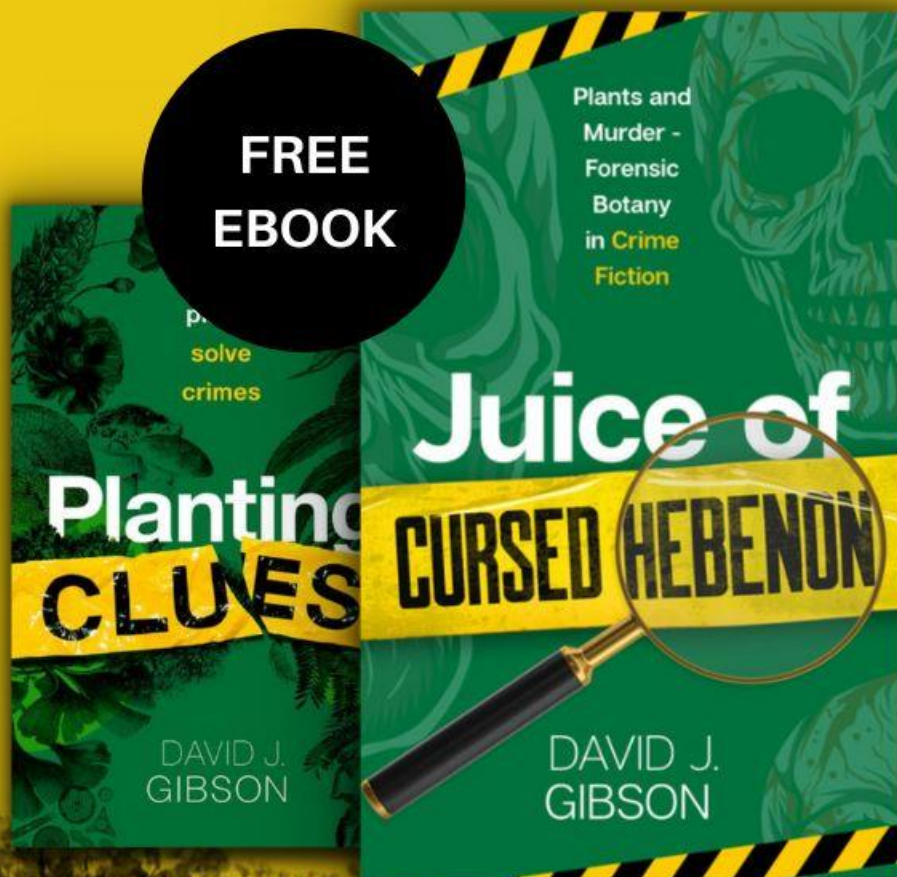
- Illegal
- Furniture, blinds,
- \$1,000
- CITES / listed
- Lack of
- problem



8: Forensic Botany in Fiction

- Whodunit mysteries
- Tracking murders
- Identifying poisons
- Shakespeare
- Agatha Christie
- Sherlock Holmes
- Cadfael Chronicles
- Peggy Lee Garden Mysteries
- Claire Sharples investigations
- Movies & TV Shows





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Planting Clues, discover
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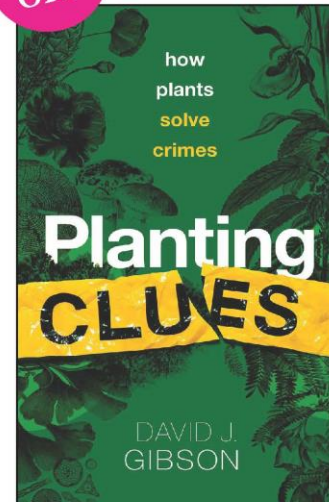
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David J. Gibson is Professor of Plant Biology and University Distinguished Scholar at Southern Illinois University Carbondale



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