

SCIENCE IN THE ERA OF STANDARDIZATION

SCIENTIFIC FOUNDATIONS SESSION #1 –
NATIONAL COMMISSION ON FORENSIC SCIENCE MEETING
9 JANUARY 2017

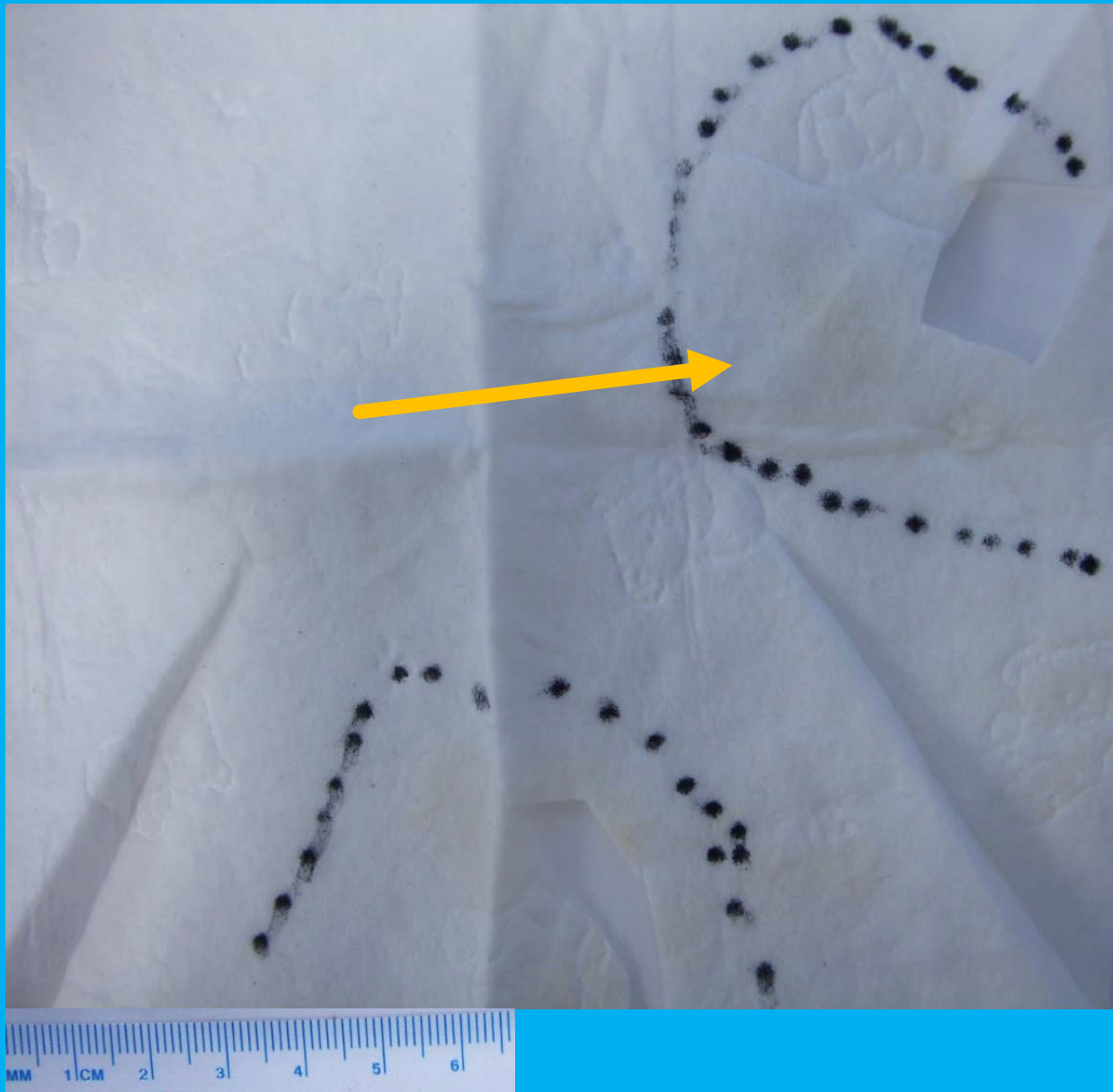
Christopher S Palenik, Ph.D.



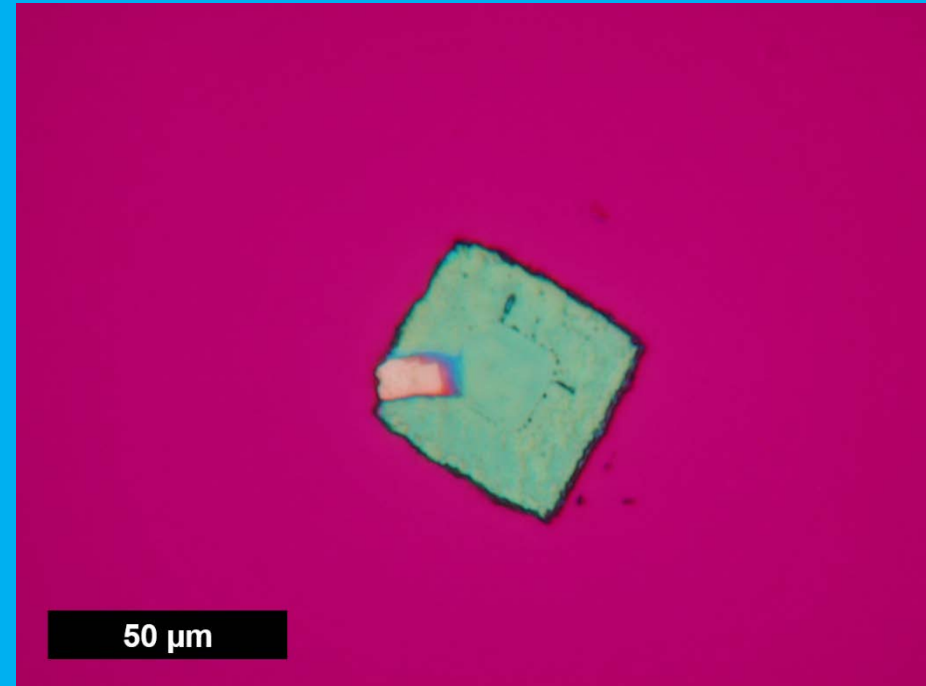
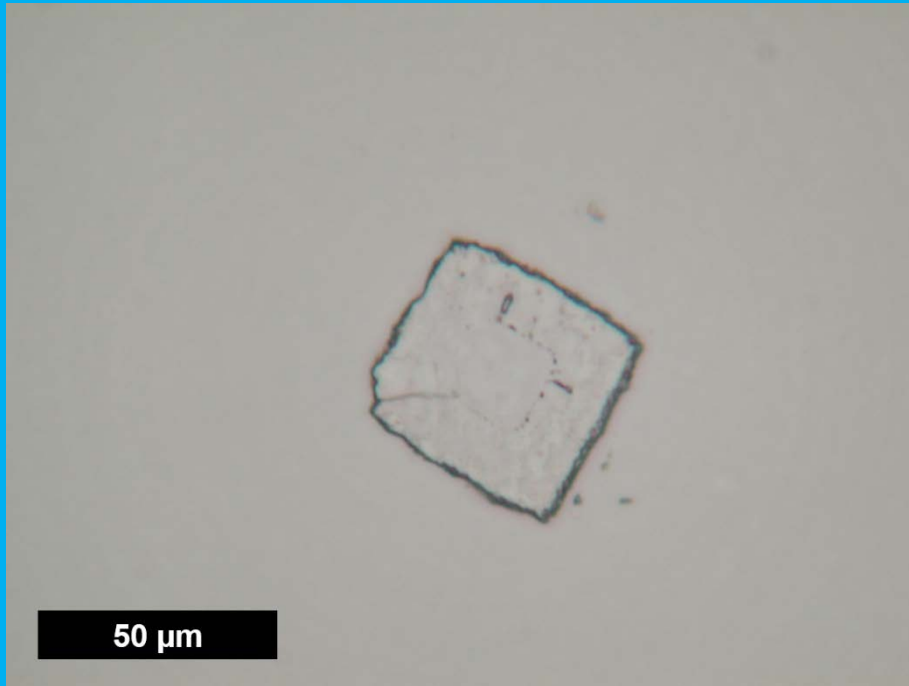
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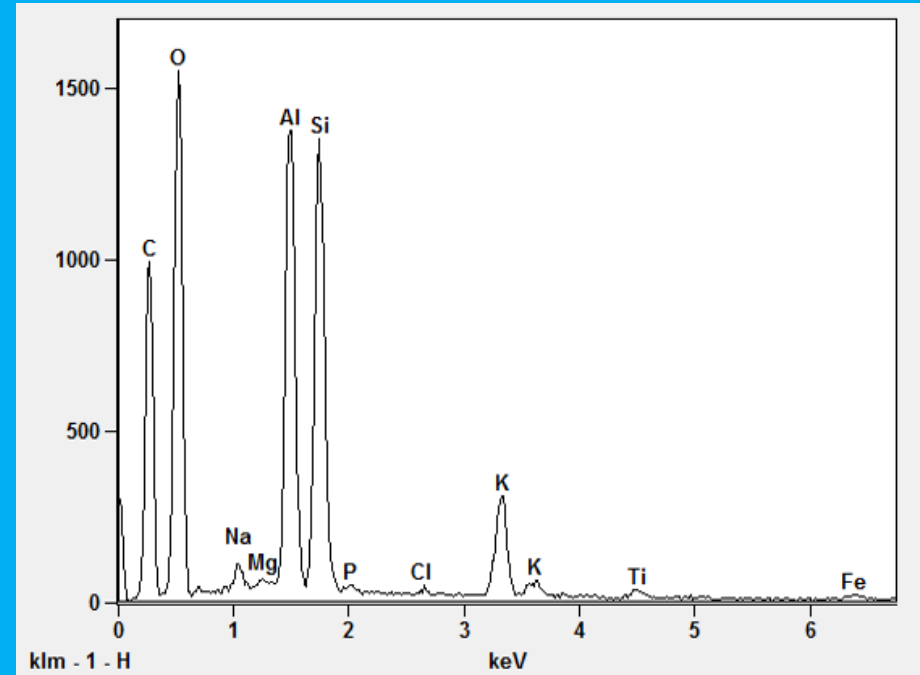
CASE EXAMPLE



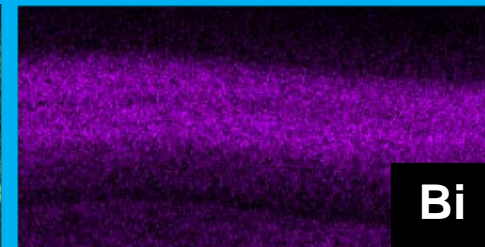
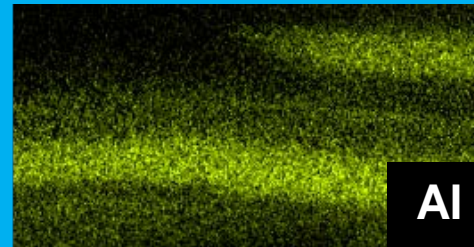
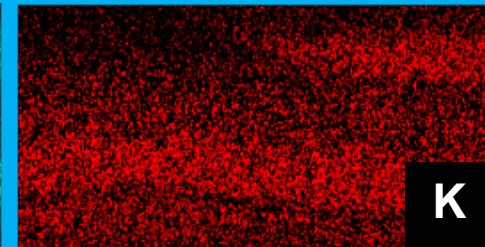
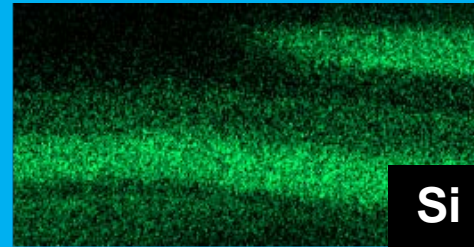
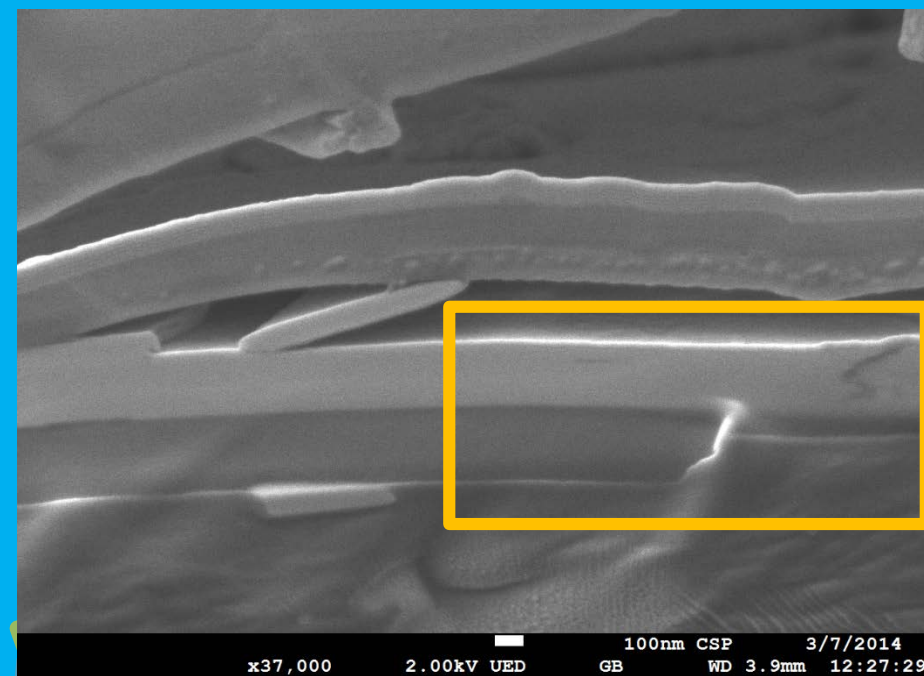
POLARIZED LIGHT MICROSCOPY



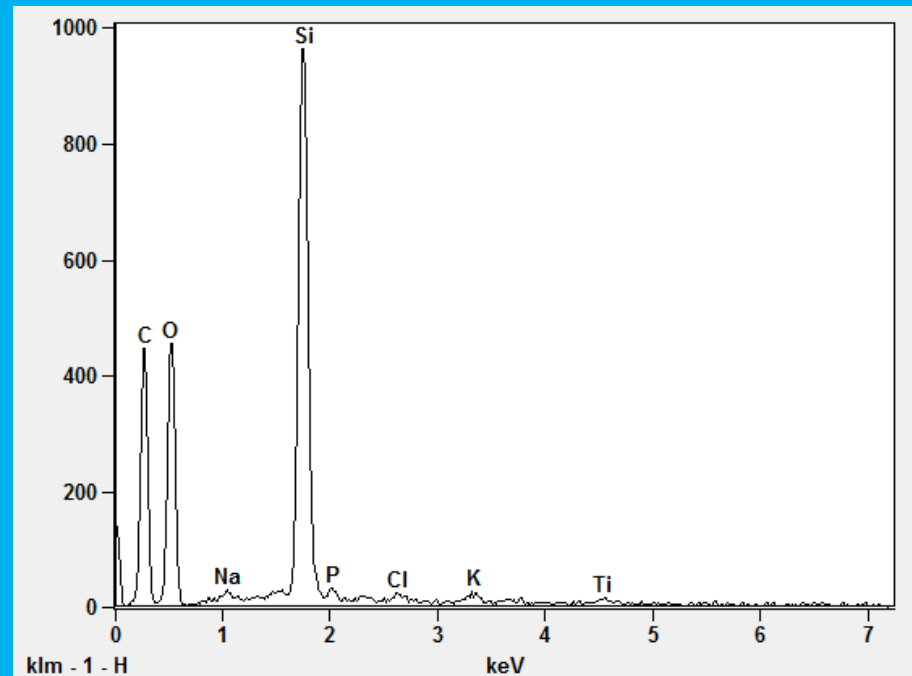
SCANNING ELECTRON MICROSCOPY



ELEMENTAL MAPS OF MICA IN CROSS-SECTION



FREE SILICA MICROSPHERE



FORENSIC SCIENCE AS INVESTIGATIVE TOOL

Coated Mica

+ Silica Spheres

+ Fine Glitter Particles

+ Titanium Dioxide Particles

=





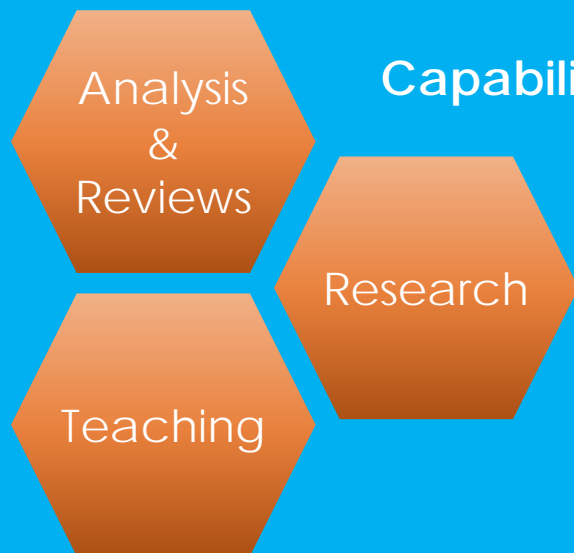
Areas of Expertise

International/Federal/State/Local



Clients

Microtrace



Capabilities



Quality

Community Involvement



QUESTION DURING INTERPOL PANEL

You are applying forensic science to questions of not only comparison, but also identification, sourcing, and route attribution.

My staff can't use the microscope and is unable to identify unknown materials, much less synthesize that data into the framework of an investigation.

How would you suggest we educate a new generation of forensic scientists to take a more fundamental scientific approach to their cases?



BEYOND EDUCATION

In the midst of an era of unprecedented efforts into

- ▶ Quality
- ▶ Standardization
- ▶ Statistics

Is the discipline of forensic science
missing something of great significance?



EVOLUTION OF A FORENSIC APPROACH

Case Driven → Task Driven



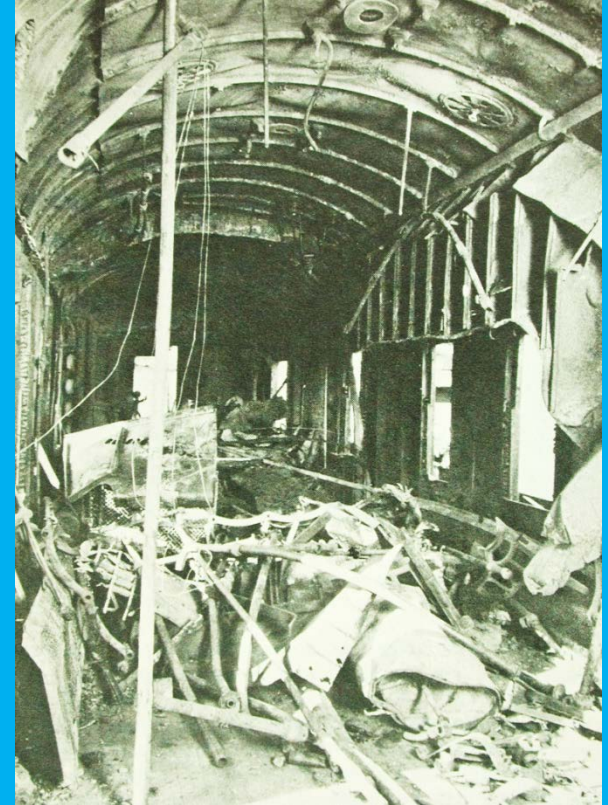
EVOLUTION OF A FORENSIC APPROACH

Task Driven Implications

This impacts:

- ▶ Evidence collection
 - ▶ Without a comparison sample, evidence will be returned by the lab
- ▶ Analysis
 - ▶ Evidence will be missed or ignored b/c its not part of my protocol.
 - ▶ Testimony that proper science was ignored b/c the it wasn't specified in the protocol
- ▶ Interpretation & Data Synthesis
 - ▶ In complex cases, or with complex samples, multiple reports are issued with no attempt at synthesis.

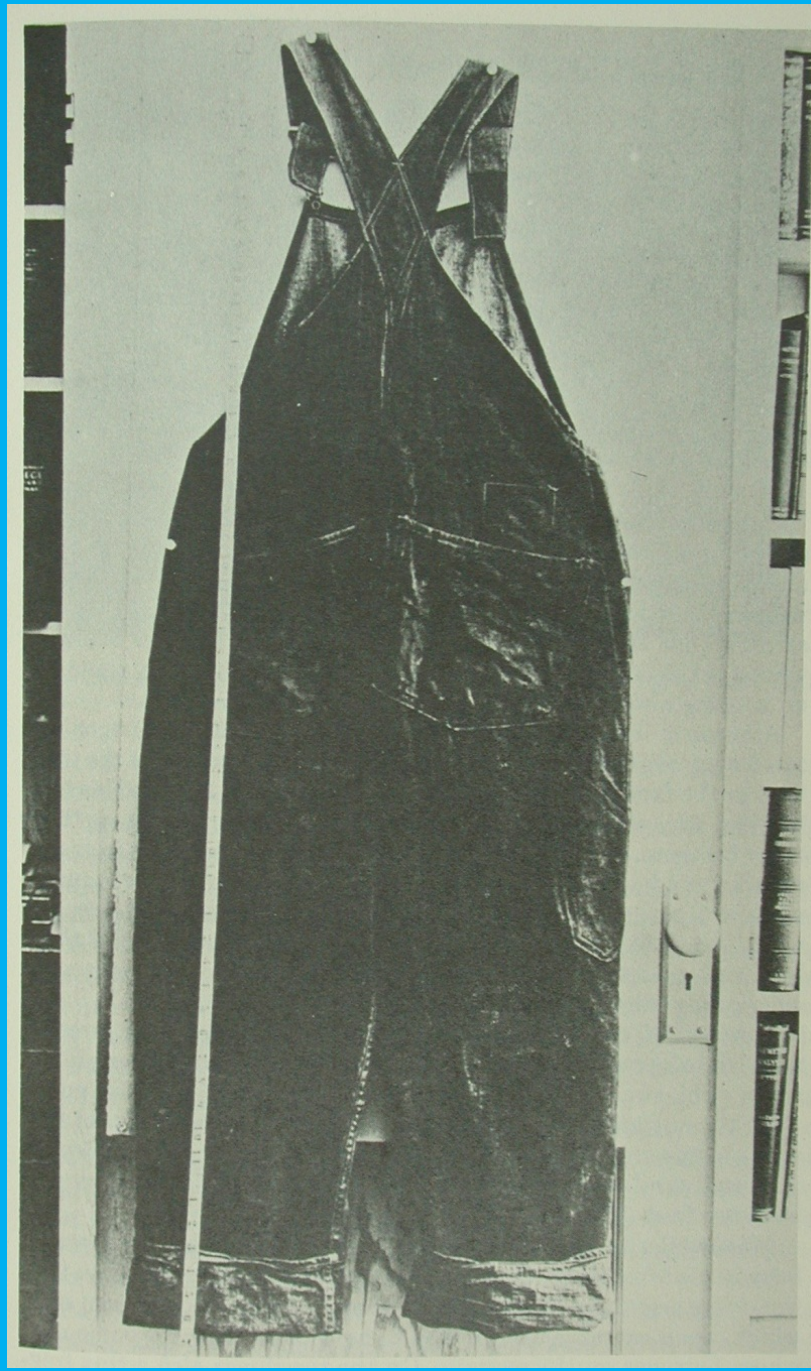




SISKIYOU TRAIN ROBBERY – OCTOBER 1923

OREGON









RECEIPT FOR REGISTERED ARTICLE

Registered at the Post Office Indicated in Postmark

Complete record of registered mail is kept at the post office, but the sender should write the name of the addressee on back hereof as an identification. Preserve and submit this receipt in case of inquiry.

POSTMASTER,

Form 3806.

Per

No. _____

Class postage _____

Postmark clearly,
showing
date and office.

CS-6852



REWARD!

\$14,400.00

Holdup of Southern Pacific Train No. 13, 1st Section, at Siskiyou, October 11, 1923

FOUR MEN KILLED

Reward of \$2500.00 will be paid by the Southern Pacific Railroad Company, of \$300.00 by the American Railway Express Company, and not to exceed \$2,000.00 by the United States, for the arrest and conviction of each person implicated in the holdup.

At least three persons participated in the crime. Below are photographs and descriptions of three brothers who are believed to have been connected with the holdup and who should be arrested on sight and held incommunicado.



DESCRIPTIONS

PRESENT DAY TRACE EVIDENCE REPORT

The paint from item 12 was consistent with paint from items 18 19 in color, type, layer structure and elemental composition.

This means that the unknown paint and the paint standards could share a common source.



DEAUTREMONT CASE TODAY

1. **Case wouldn't be accepted at many labs**
 - ▶ There were no comparison samples.
2. **Case would be outside the accredited scope of most trace labs**
 - ▶ Evidence involved wood and sap.
3. **Evidence would be split among sections**
 - ▶ Results would be reported as two or three separate reports rather than one cohesive report.
4. **Template-based reporting is not set-up to synthesize information.**
 - ▶ The DeAutremont report required more than a standardized report wording.



IMPACT OF CURRENT APPROACHES

We see a decrease in...

- ▶ the quantity of traces being left at a scenes,
- ▶ trace evidence being collected,
- ▶ the relative value of the evidence,
- ▶ the need for trace due to other types of evidence such as DNA.

Do we sill need trace evidence?



TRACE AS A PROXY

**DNA HANDLES ONE MOLECULE,
WE TAKE CARE OF THE REST**

-- Slogan of the American Society of Trace Evidence Examiners

These examples represent not only trace evidence,
but are a proxy for any
atypical, complex, or novel sample or analysis
in any forensic discipline

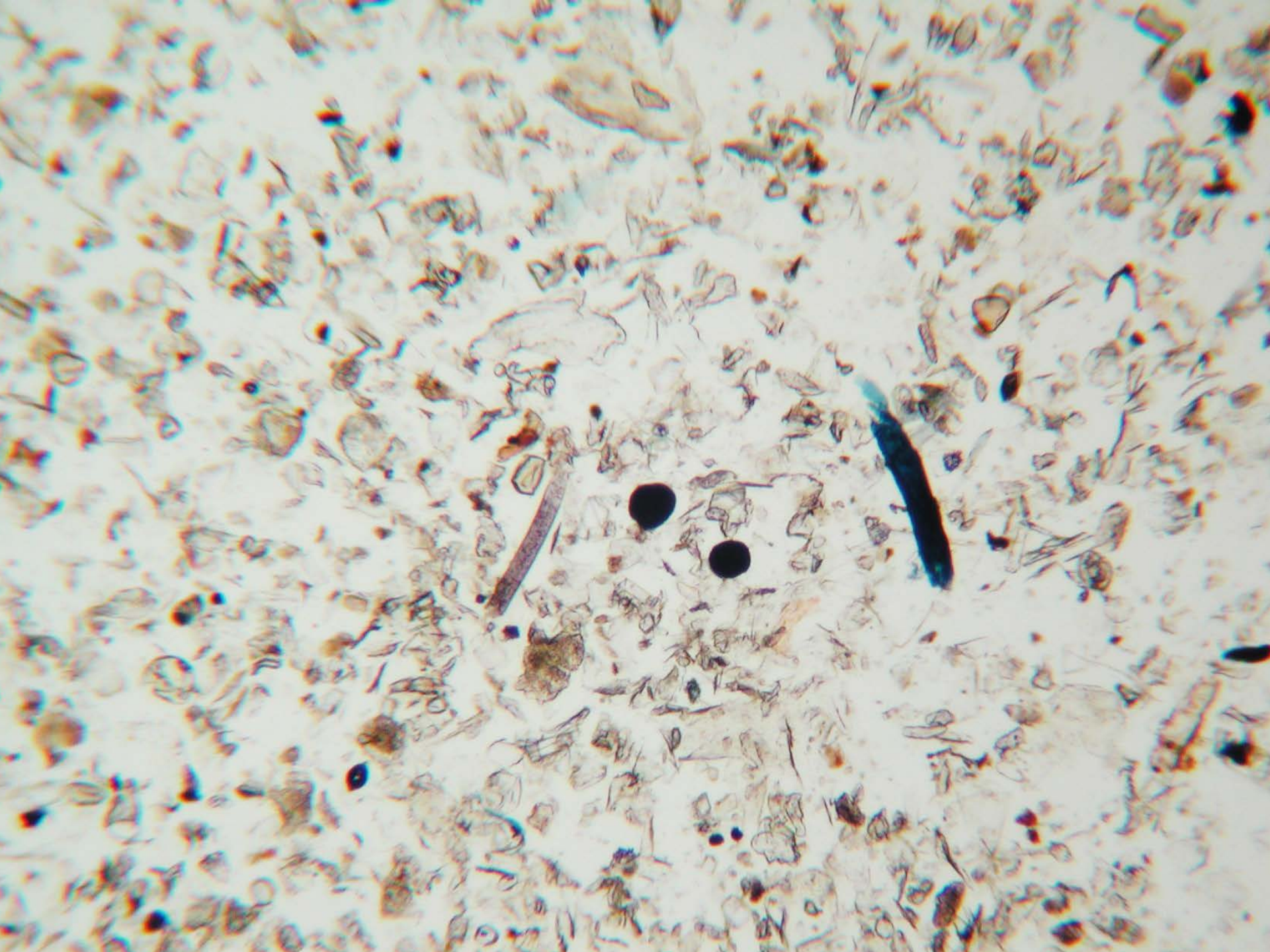


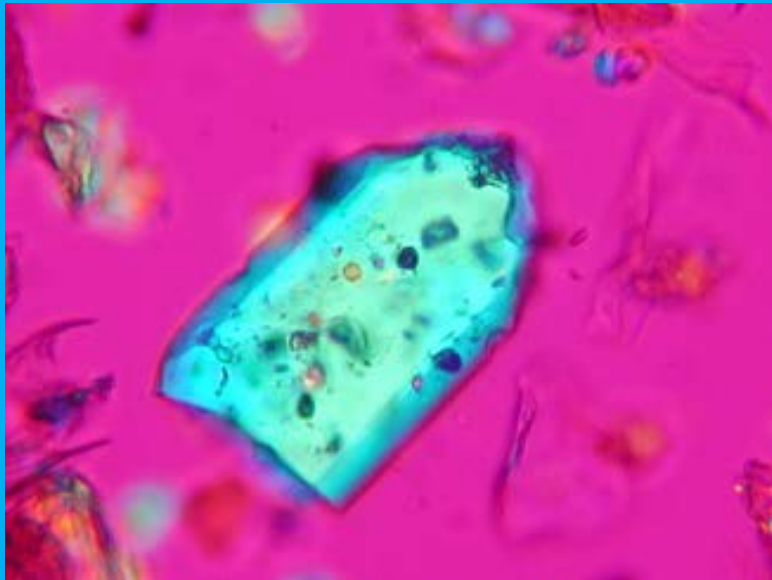
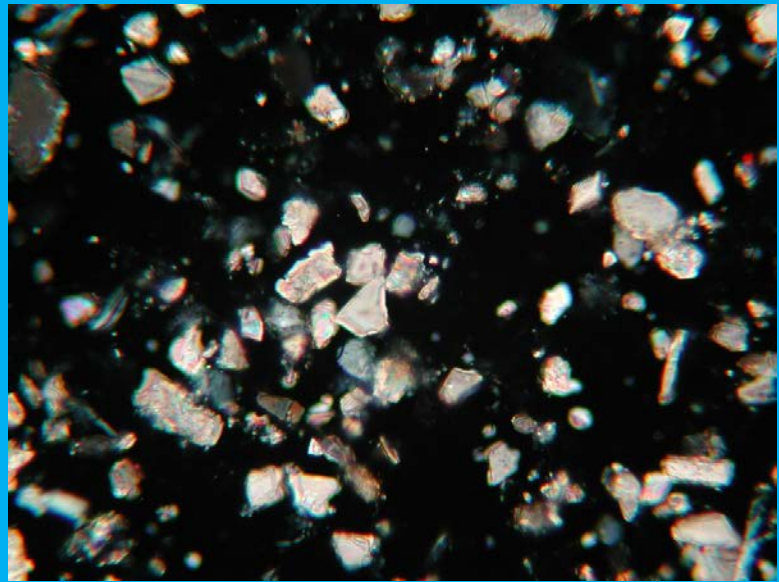
DO WE STILL NEED TRACE?



SOURCE ATTRIBUTION EXAMPLE RECOVERED DUST







SOURCE ATTRIBUTION EXAMPLE

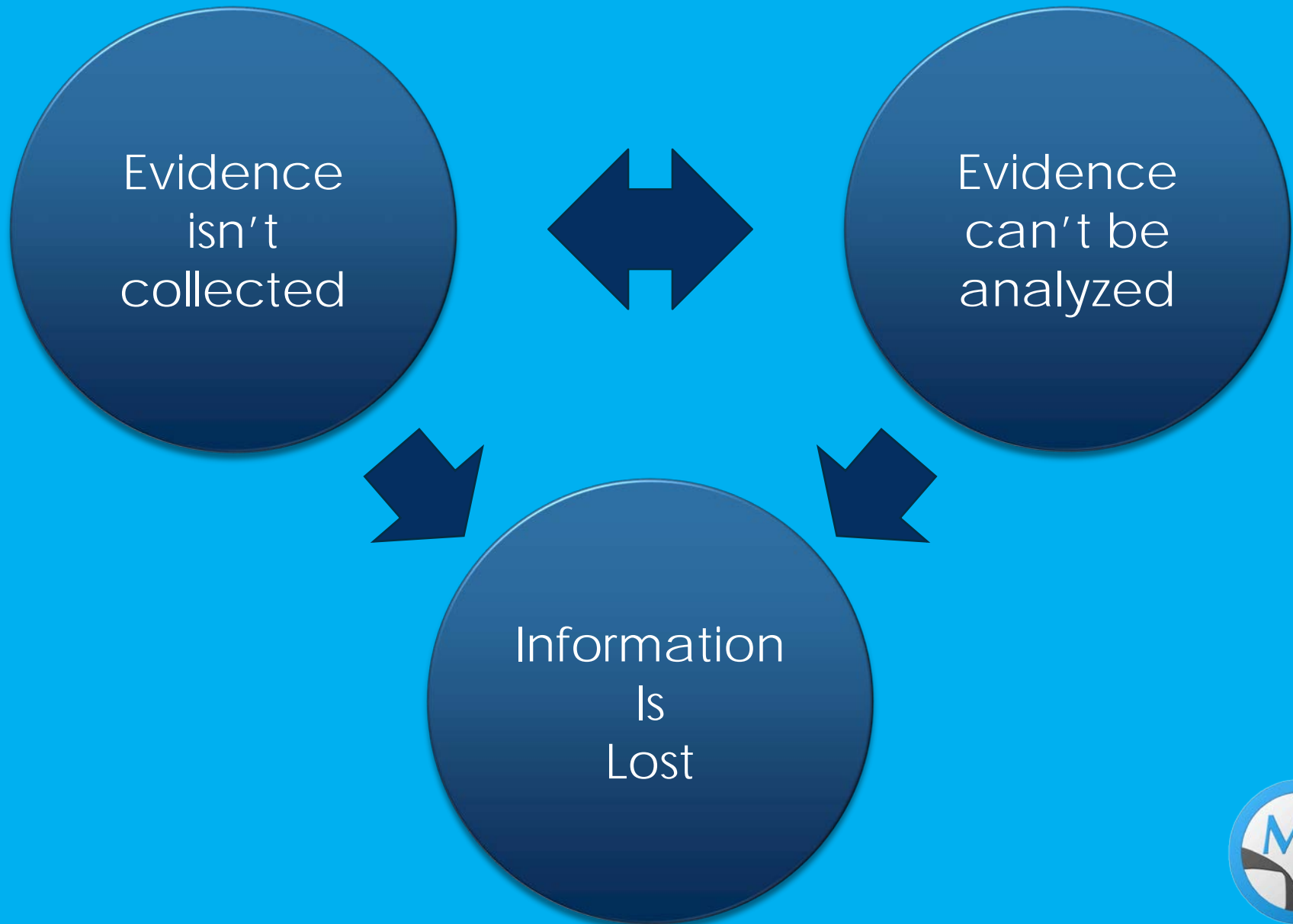
RECOVERED DUST

- ▶ Same dust on both jerseys indicates they were worn at the same location.
- ▶ Oak Pollen
 - ▶ Dust was picked up around March
- ▶ Calcite and Gypsum
 - ▶ Suggests drywall installation
- ▶ White spray paint
 - ▶ Suggests a commercial building site





DO WE NEED TRACE?



HOW DID WE GET HERE?

- ▶ Consider the impact of these topics:
 - ▶ Protocols and Standardization
 - ▶ Quality Management
 - ▶ Statistics & Significance

The benefits of and need for the above
topics have been well covered
...what are their downsides?



ONE SIZE DOES NOT FIT ALL

► Protocols & Standardization

- Trace evidence has large numbers of methods, materials, and questions.
- It's not practical to write specific protocols that cover every scenario.
- The materials and results are not amenable to statistical interpretation.
- Trace requires flexibility to exploit to the specific qualities of a given sample...something difficult to cover in an SOP.
- The general approach has been to reduce *scope*, reduce *instrumental approaches*, and reduce the *range of questions being asked*.



ONE SIZE DOES NOT FIT ALL

► Quality Systems

- Designed to do the same thing, the same way, multiple times.
- This is at fundamental odds with the range of materials and questions seen in trace evidence
- Inertia: Tendency to maintain the status quo.
- New approaches, unusual observations, and unusual samples may not be captured and thus cannot be treated.
- The effort is not considered worthwhile for a single sample.
- Deviations typically requires supervisor approval

The result: Practitioners are encouraged to approach samples as a technician, rather than a scientist.



ONE SIZE DOES NOT FIT ALL

► Statistics & Significance

- DNA results in huge probabilities resulting in (possibly) some of the most definitive answers achievable by science.
- Statistics have not been achievable for most types of trace evidence to date.
- Even if statistics are developed, how does a jury evaluate their significance?
 - If a probability of 99.999% provides a comfortable certainty to a jury, what about 99% or 95% or 65%
 - Is it practical to develop a threshold for guilt?
 - Does a number provide more clarity to a jury?
- There are some situations where statistics aren't practical. Yet, this does not mean that an association has no value.



CASE

- ▶ Multiple black acrylic fibers were found on the suspect's black cotton shirt.



- ▶ These were compared to fibers from the sweatshirt found at the scene:



WHAT PROVIDES MORE USEFUL INFORMATION TO A JURY?

Statistics

- ▶ We typically don't know the number of sweatshirts made.
- ▶ We can't make an accurate assumption about the anticipated local distribution of the shirt.
- ▶ We can't know if other items used the same fiber.
- ▶ What probability of 95% or 80% or 65% certainty mean to jury? How do they weigh that value in the context of their own experience?



WHAT PROVIDES MORE USEFUL INFORMATION TO A JURY?

- ▶ Multiple black acrylic fibers were found on the suspect's undershirt. When compared to fibers from the sweatshirt found at the scene:
 - ▶ Both exhibit a round cross section
 - ▶ The same diameter (within error)
 - ▶ The fibers are 1" staple with a dtex of 2.2
 - ▶ The birefringence is 0.003 with n's 1.515 and 1.518
 - ▶ They fluoresce bright orange-red when excited with blue light with the fluorescence microscope
 - ▶ The fibers are PAN with a MA copolymer
 - ▶ Both IR spectra are similar and contain an unidentified band that, upon extraction are due to a dyestuff or other extractable component.
 - ▶ Both are dyed with the same three dyes at the same relative concentrations.



TAKE HOME

- ▶ Amidst the quality management, statistics, and error rates, it is critical that we find ways to *explicitly* encourage strengths of forensic science that may be overlooked while attempting to standardize large volume types of evidence:
 - ▶ New & unusual types of evidence
 - ▶ New & unusual analytical approaches
 - ▶ Free application of scientific thought
 - ▶ Scientifically supported expert discretion



HOW DO WE SUPPORT THIS?

Each stakeholder can has a role:

- ▶ Practioners
 - ▶ Provide thoughtful analysis: from sampling to testimony
- ▶ Lab Directors
 - ▶ Consider models such as Australia's approach to complex cases
 - ▶ Transparency of discovery information (NC discovery packets)
- ▶ Educators
 - ▶ Challenge: Scientists from other disciplines routinely become forensic scientists. Currently, the converse is not possible. Change this.
- ▶ Researchers
 - ▶ Work with practioners to provide research that provides practical benefit to the discipline.
- ▶ Legal Community
 - ▶ The adversarial system requires adequately prepared console in order to properly convey both sides of an expert's testimony
- ▶ Policy Makers
 - ▶ Give credit to the existing experts in a field
 - ▶ Take time to understand the history and subtleties of a sub-discipline
 - ▶ Suggest a pathway and provide positive support to improve current practices
 - ▶ Consider the impact on state, local, and private laboratories





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