DRUG ANALYSIS LAB REPORTS 101

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LEARNING OBJECTIVES

1. Learn to read lab reports in drug analysis cases
2. Improve attorneys' ability to issue spot
3. Improve attorneys' ability to determine when expert assistance is needed
4. Build skills for voir dire and cross-examination of experts

WHY DO I NEED TO UNDERSTAND THE LAB WORK?

- Be able to identify triable issues
- Help non-scientist jurors and judge understand where there are deficiencies in the analysis
- Incorporate the science into the theme of your case
- Start talking to jurors about science starting with voir dire
- It's your ethical obligation to provide an effective defense for your client!

BEFORE YOU START –
DO YOU HAVE A COMPLETE LAB REPORT?

2-PAGE SUMMARY "LAB REPORT" IS NOT SUFFICIENT

SHOULD BE 30+ PAGES

SHOULD START WITH A TABLE OF CONTENTS

DOES TABLE OF CONTENTS SAY "CASE RECORD (FULL) OR CASE RECORD (AD HOC)?

WHAT IS IN "ADDITIONAL FILES"

TROUBLESHOOTING IF YOU DIDN'T GET COMPLETE FILE

“LABORATORY REPORT”

- Gives conclusions
- Lists methods used
- Explains which item(s) were tested
-  Gives weight

WEIGHT

- Net weight = weight of item without packaging
- Gross weight = weight of item with packaging
- Will report net weight unless it is not possible to separate item from packaging. See Technical Procedure for Balances-Drug Chemistry.
- Will give uncertainty budget and level of confidence. These refer only to confidence in weight, not in identification of the drug.

“CASE REPORT”

- Suspect name, gender, DOB, SID
- Why does this matter? See Itiel Dror’s research on cognitive bias and forensic analysis in the fields of fingerprint, DNA, forensic anthropology, and forensic pathology. Potential topic for cross-examination.

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PAPER | Open Access

Cognitive bias in forensic pathology decisions

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Abstract

Forensic pathologists' decisions are critical in police investigations and court proceedings as they determine whether an unnatural death of a young child was an accident or homicide. Does cognitive bias affect forensic pathologists' decision-making? To address this question, we examined all death certificates issued during a 10-year period in the State of Nevada in the United States for children under the age of six. We also conducted an experiment with 133 forensic pathologists in which we tested whether knowledge of irrelevant non-medical information that should have no bearing on forensic pathologists' decisions influenced their manner of death determinations. The dataset of death certificates indicated that forensic pathologists were more likely to rule "homicide" rather than "accident" for deaths of Black children relative to White children. This may arise because the base-rate expectation creates an *a priori* cognitive bias to rule that Black children died as a result of homicide, which then perpetuates itself. Corroborating this explanation, the experimental data with the 133 forensic pathologists exhibited biased decisions when given identical medical information but different irrelevant non-medical information about the race of the child and who was the caregiver who brought them to

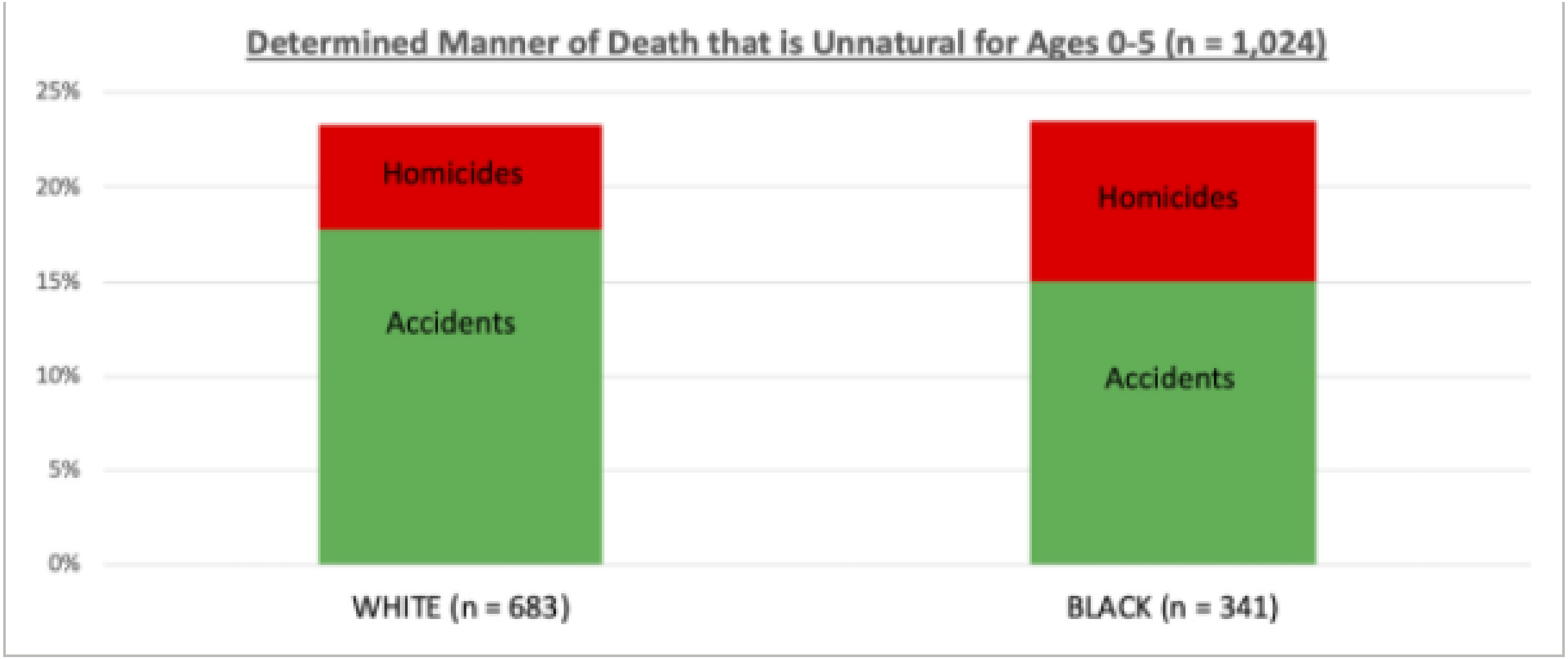


FIGURE 2

Open in figure viewer | PowerPoint

Forensic pathologists were more likely to attribute the deaths of Black children to homicide, relative to White children; whereas the deaths of White children, relative to black, were more likely deemed accidental

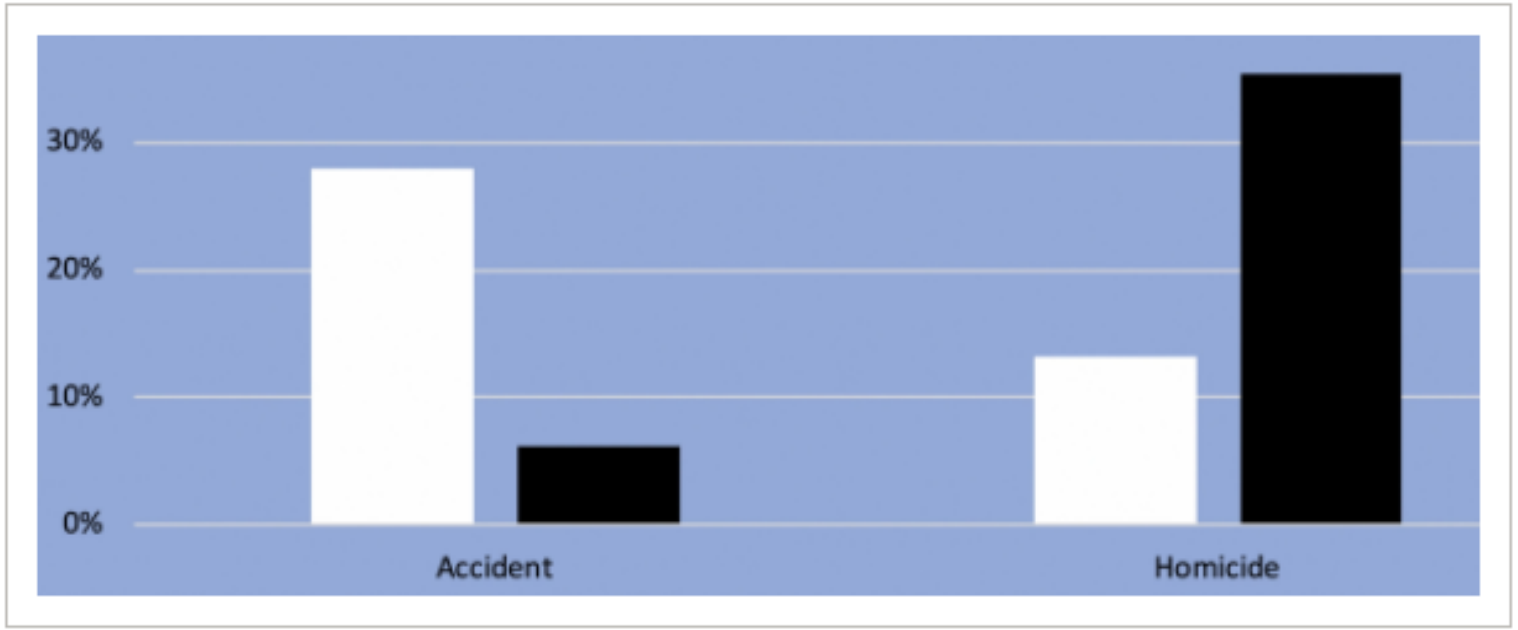


FIGURE 3

Open in figure viewer | PowerPoint

With identical medical findings, the proportion of forensic pathologists determining that the manner of death was an "accident" (left panel) vs. a "homicide" (right panel). White bars are for White children with the grandmother as a caretaker; Black bars are for Black children with the mother's boyfriend as a caretaker. When the forensic pathologists could not reach a decision (an "accident" or "homicide") with confidence, they concluded that the manner of death was "undetermined"

Name Answer Key Date

CHAPTER 9

Chapter Test B

For use after Chapter 9

Find the sum or difference.

1. $(4a^3 - 2a + 1) - (a^3 - 2a + 3)$
2. $(3x^3 + 4x + 14) + (-4x^2 + 21)$
3. $(3d - 5d^2 + 2) - (6d^2 + 5d - 1)$
4. $(-3n + 7n) + (4n^3 - 2n^2 + 12)$

In Exercises 5 and 6, use the following information.

During the period 1985–2012, the projected enrollment B (in thousands of students) in public schools and the projected enrollment R (in thousands of students) in private schools can be modeled by

$B = (-18.53t^2 + 975.8t + 48{,}140)$ and $R = (80.8t + 8049)$

where t is the number of years since 1985.

5. Write an equation that models the difference in the projected enrollments for public schools and private schools as a function of the number of years since 1985. B - R

Answers

1. $3a^3 - 2$
2. $3x^3 - 4x^2 + 4x + 35$
3. $-13d^2 + 7d - 3$
4. $4n^3 + 12$
5. $-18.53t^2 + 895t + 40{,}091$
6. 50,579 thousand students
7. $36c^3 - 20c^2 - 32c$
8. $5y^2 + 17y - 12$

SUBMISSION FORM = ANSWER KEY

P. 6 – Officer tells scientist what substance he believes it is

CHECK DATES AND TIMES OF ANALYSIS

Was sufficient time spent on the analysis, report preparation, and peer review?

Consider cross-examination on inappropriate amount of time spent

LOOK FOR COMMENTS FROM REVIEWER

Dialogue between analyst and reviewer may indicate disagreement between analysts.

Consider – is the disagreement substantial? Does it call into question the work of the analyst or the methodology used? Should a 702 challenge be made?

CHAIN OF CUSTODY

- Compare with information about dates and times on previous pages
- If there has been significant delay in the case, what is the cause? Delay in submission of evidence? Lab backlog? Delay after lab report is completed?

REQUEST FOR EXAMINATION OF PHYSICAL EVIDENCE

- Review for potentially biasing information about suspect and victim

MESSAGES

- Summary of any communication about the case with DAs, law enforcement, defense counsel
- Analysts are available for pre-trial conferences with the defense

WORKSHEETS

- Handwritten notes not allowed at NCSCL
- All observations should be entered into the electronic case file using worksheets
- In discovery you get a printout of the information stored in each tab

CASE NOTES - SAMPLING

- If the entire item of evidence was not tested and a sampling plan was used to determine what portion to test, it will be described here.
- There are 3 types of sampling plans:
  - Administrative – test one item (for pills)
  - Threshold – test up to a threshold weight
  - Hypergeometric – test a statistically-determined number of items and make an inference about the rest

See Administrative Procedure for Sampling

Consider – is the sampling plan a reliable method for testing a representative portion of the evidence? If not, make a 702 challenge.

CASE NOTES - METHOD OF ANALYSIS

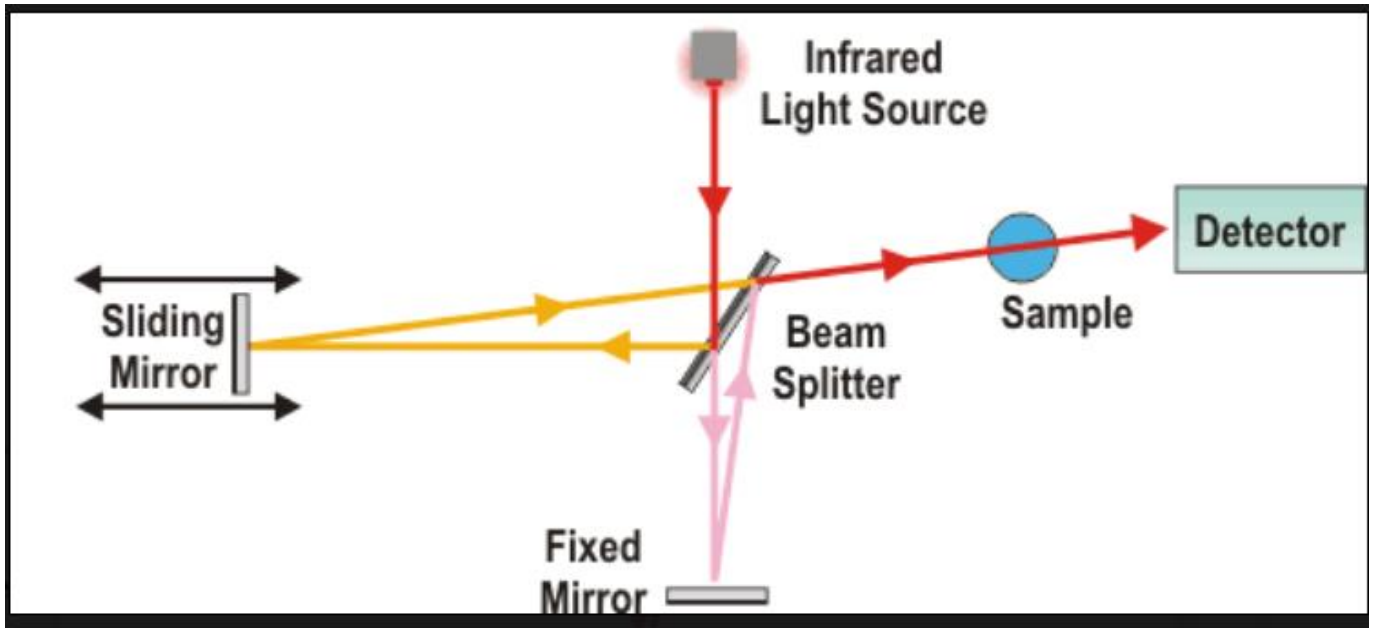
- Identify the name of presumptive test and the result
- With the name of the color test, look at the NIJ's Color Test Reagents/Kits for Preliminary Identification of Drugs of Abuse for more information about what color change should be observed
- Note any inconsistencies in test results and consider consulting an expert.
- Note whether more than one confirmatory test (such as FTIR and GC-MS) was performed and determine why. Consider consulting an expert.

CASE NOTES - OTHER

- Note information about packaging and descriptions of items
- Note whether returned in lab packaging
- Note weight received and weight returned and if the amount of sample consumed was appropriate (approx. 0.01 g)

FOURIER TRANSFORM INFRARED SPECTROSCOPY

A beam of light is shined on a sample. Different functional groups that make up the sample reflect the light in different ways and produce peaks on a spectrum. The peaks make up a "chemical fingerprint" which can be used to identify the sample.



http://analyticalprofessional.blogspot.com/2013/05/fourier-transform-infrared-spectroscopy.html

FTIR – WHAT TO LOOK FOR

- Look at top of page to find name of method, date and time of run
- Look at bottom of graph to find what item is being tested
- Blank should be run first to demonstrate that instrument is clean
- Item of evidence is run immediately after the blank
- Compare to a known reference standard either from a lab-generated collection or a published source
- Analyst looks for characteristic peaks

FTIR LIMITATIONS

- An IR spectrum by itself does not provide an exact chemical structure of a compound, but will provide information about functional groups that are present in the molecule. Presence of absence of certain functional groups will guide an analyst as to the possible identify of a compound.
- Mixtures: For an accurate spectrum, the substance must be reasonably pure (generally >90%). Testing of pharmaceuticals using IR may be more successful than the testing of street drugs which are often impure. Look for subtractions to indicate possible mixture
- Subjectivity: Interpretation of data involves subjectivity

WHY USE FTIR?

- Faster
- Less sample preparation
- Cheaper

SUBJECTIVITY OF METHOD PRIOR TO SEPT 2020

Technical Procedure for Infrared Spectroscopy
Drug Chemistry Section
Issued by Drug Chemistry Technical Leader

Version 9
Effective Date: 04/07/2017

5.4.3.2 An IR spectrum of a controlled substance shall compare favorably to the IR spectrum of a known reference standard before an identification is confirmed.

5.4.3.3 When using FTIR as the primary structural elucidation technique, the sample spectrum shall compare favorably with a spectrum of a known standard in both its overall appearance and in the presence and location of major peaks.

"Shall compare favorably" = eyeballing

5.4.2.2 Compare the unknown spectrum to a known reference material.

5.4.2.2.1 Six prominent and well-defined peaks in the sample spectrum between 2000 cm^{-1} to 650 cm^{-1} shall be labeled. The same six peaks shall be present within +/- 1 cm^{-1} of those in the reference spectrum during comparison for identification.

- If there are less than six prominent and well-defined peaks in the sample spectrum between 2000 cm^{-1} to 650 cm^{-1} then all peaks shall be present within +/- 1 cm^{-1} of those in the reference spectrum during comparison.

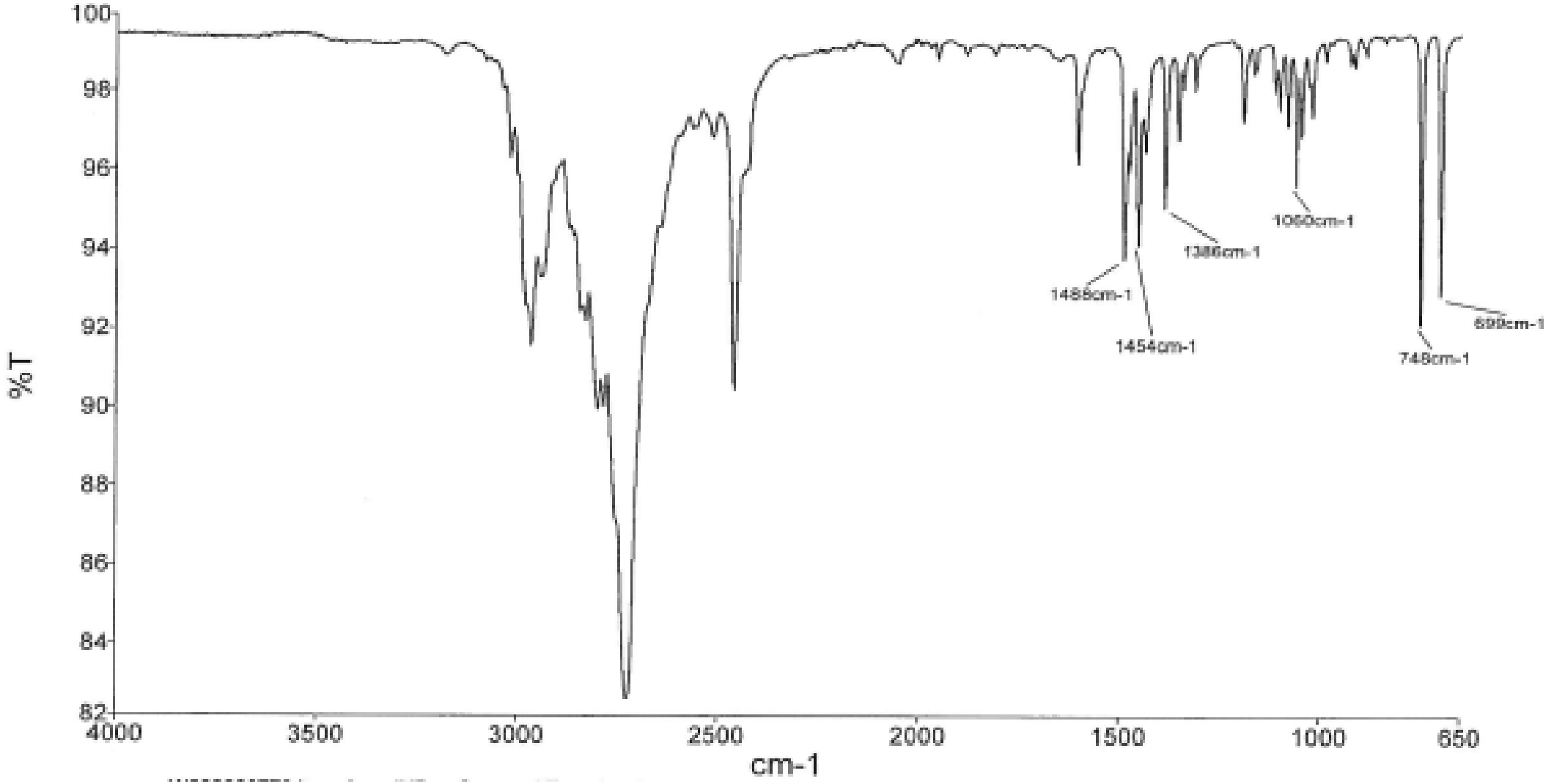
5.4.2.2.2 The overall spectral pattern shall correspond to that of the reference material in regards to the absence or presence of major peaks and relative peak intensities.

5.4.2.2.3 No prominent unexplainable extraneous peaks shall be observed in the sample spectrum.

PerkinElmer Spectrum IR Version 10.6.2
Tuesday, December 8, 2020 1:43 PM

Analyst
Date

FTIR 12 Frontier SN 115027
Tuesday, December 8, 2020 1:43 PM



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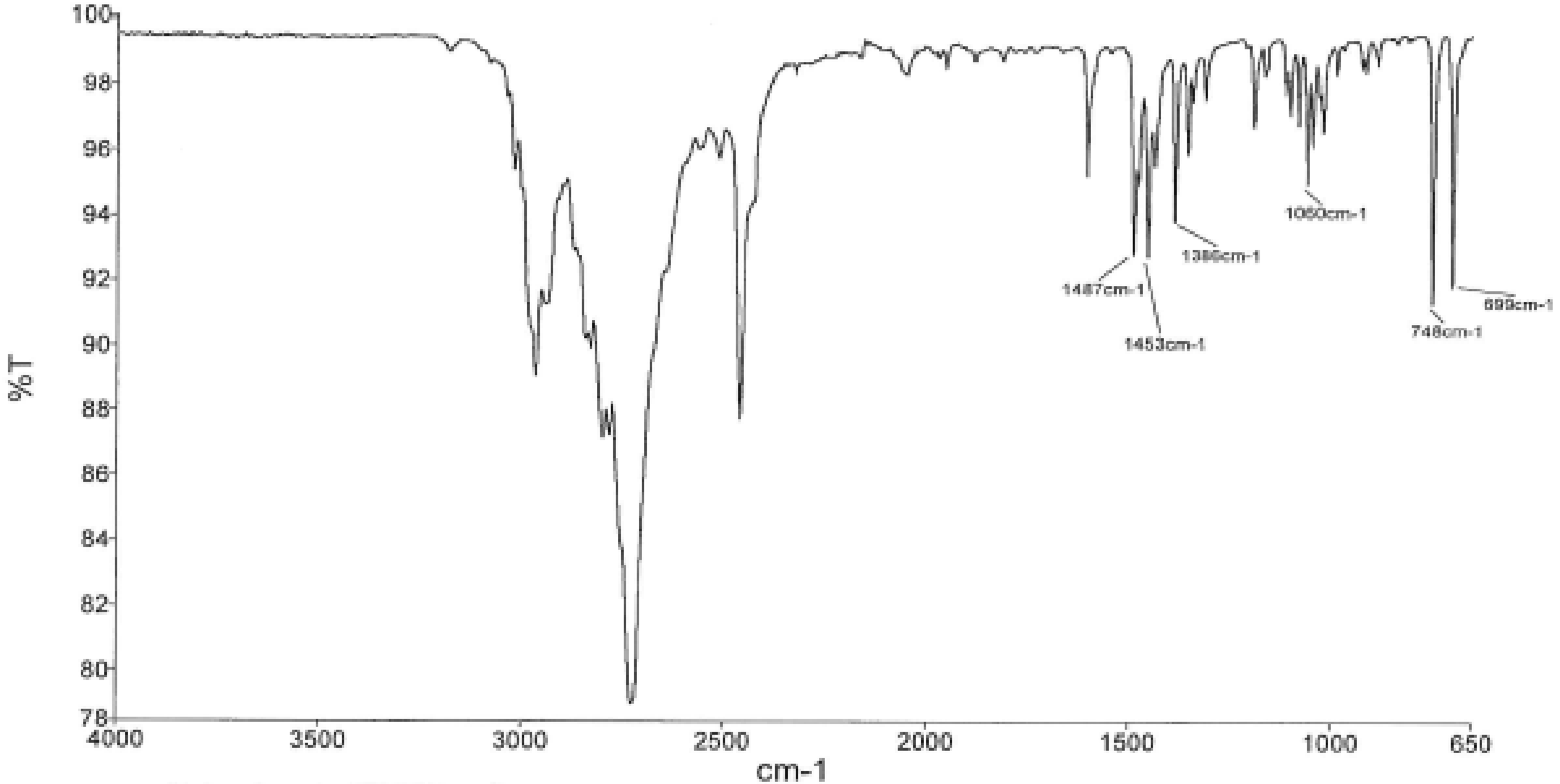
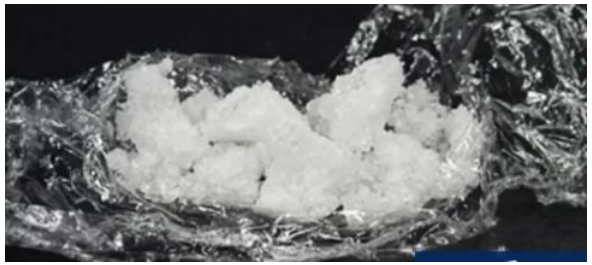


Methamphetamine HCl (RCL) Sigma M-8750 (Lot # 087K0681) (Vault ID 8-03)

FTIR LIMITATIONS – OPTICAL ISOMERS

- L-Methamphetamine
- D-Methamphetamine

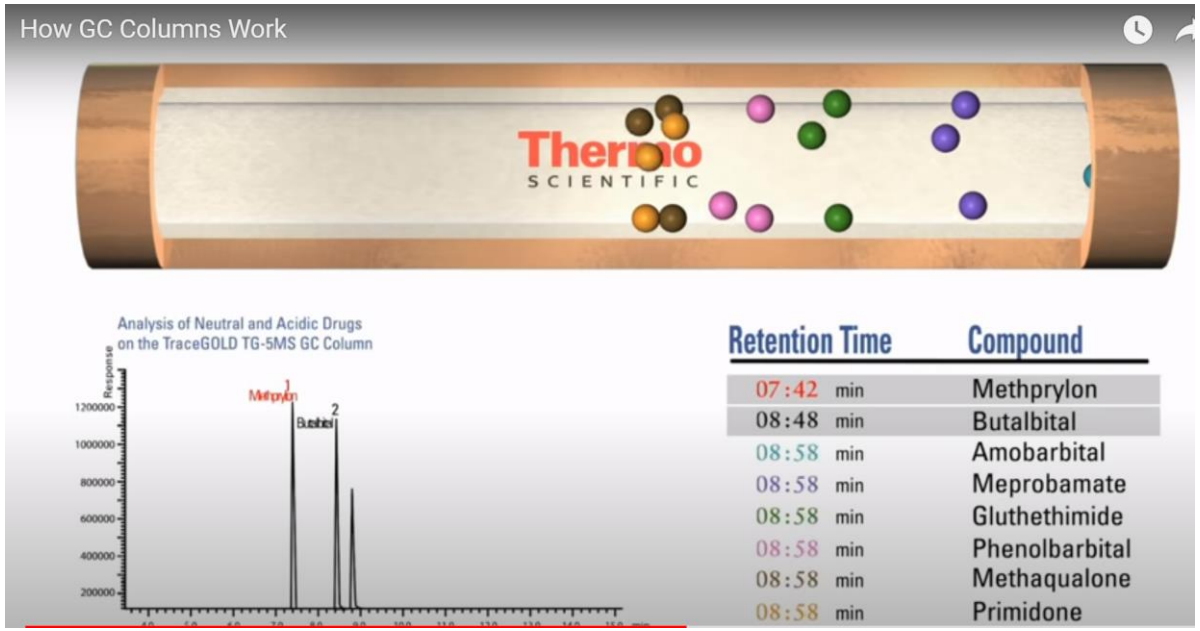


6.0 Limitations

6.1 Generally, infrared spectra cannot distinguish between optical isomers.

GAS CHROMATOGRAPHY-MASS SPECTROSCOPY (GC-MS)

https://www.youtube.com/watch?v=q0pM-k0SvOQ&ab_channel=chromatographyvideos



GC-MS

- Most reliable means of analyzing a suspected controlled substance
- A gas chromatograph vaporizes a sample and then injects it into a column and subjects it to varying temperatures causing the substance to separate into its component compounds depending on how easily each compound can be vaporized. This separation is shown on a chart with peaks showing when that compound reached the detector (retention time).
- A mass spectrometer then determines the molecular weight of each molecule or compound that has been separated by the GC.
- Note use of GC blank, analyst name, time of run

ANALYST CV

- Is their degree in a relevant scientific field?
- Is the analyst certified in their field? More information here.
  - American Board of Criminalistics – Drug Analysis
  - Requirements for certification: bachelor's degree in a natural science, has worked in the field of drug analysis of seized drugs for at least two years and is authorized to perform casework in the forensic analysis of seized drugs, pass the 200-question exam
- Years of relevant experience
- Experience testifying

THANK YOU!

For a case consultation:

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https://forensicresources.org/