

From Crime Scene to Courtroom: Inside the World of the Forensic Scientist



KELLY ELKINS, PhD

Speaker

Professor, Department of Chemistry &
Forensic Science, Towson University



JAMES C. CARVER, JD, PhD

Speaker

Partner,
The Carver Law Firm



GABRIEL FERRANTE, JD, MS

Moderator

Associate,
Goodwin Procter LLP

This ACS Webinar® is coproduced with the ACS Division of Chemistry & the Law.

The Forensic Expert



Kelly M. Elkins, Ph.D.

Chemistry and Forensic Science Department, Towson University, Towson, MD

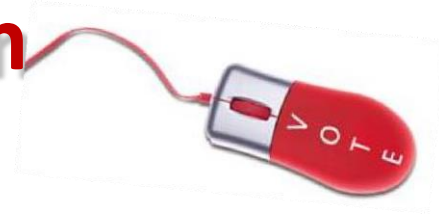
My Background

- Ph.D. in Chemistry (Biochemistry)
- Post-doctoral Fellow at MIT
- Fulbright Scholar in Heidelberg, Germany
- Adjunct faculty in Kansas and New Hampshire
- Faculty of chemistry and forensic science in Georgia and Colorado
- Forensic Chemistry faculty at Towson University
- Taught chemistry, biochemistry, and forensic science courses and conducted and published research for 20+ years
 - Reviewed case files
 - Authored and edited 8 books and developed a forensic DNA curriculum



Audience Survey Question

ANSWER THE QUESTION IN JUST ONE MOMENT



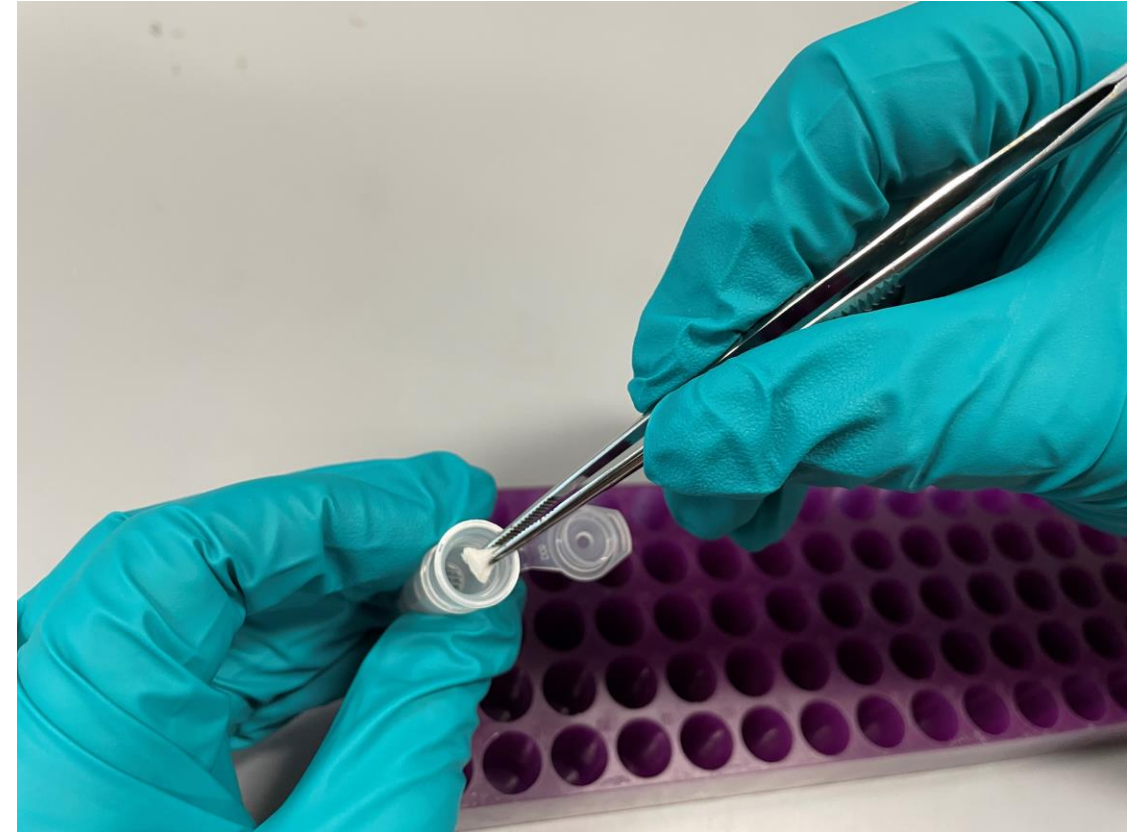
What best describes why you joined today's webinar?

- I am interested in the forensic science topic in general
- I would like to become a forensic scientist or transition into this career
- I am currently a forensic scientist or work in the forensic science field
- Other (Tell us more in the questions window)

** If your answer is OTHER tell us in the questions window!*

The job of the forensic scientist

- Collect, evaluate and screen forensic evidence
- Test forensic evidence for trace materials, drugs, accelerants, explosives, body fluids, and DNA using analytical methods
- Run appropriate QC samples and reference samples
- Follow validated and approved procedures in SOP
- Document and report findings
- Submit to requesting officer or person
- Testify in court on your findings



Steps to become a forensic scientist

1. Enroll in science and mathematics courses and perform well

2. Complete a degree in a natural science such as chemistry, biology, physics, forensic science or a related field

- FEPAC-accredited or other high-quality program (www.AAFS.org/FEPAC)
- Conduct research, do a capstone project and/or internship
- Present research and share your findings at a conference

3. Apply to jobs

- Respond to questions about personal skills and science
- Be prepared to pass a background check, financial check, drug testing and lie detector test

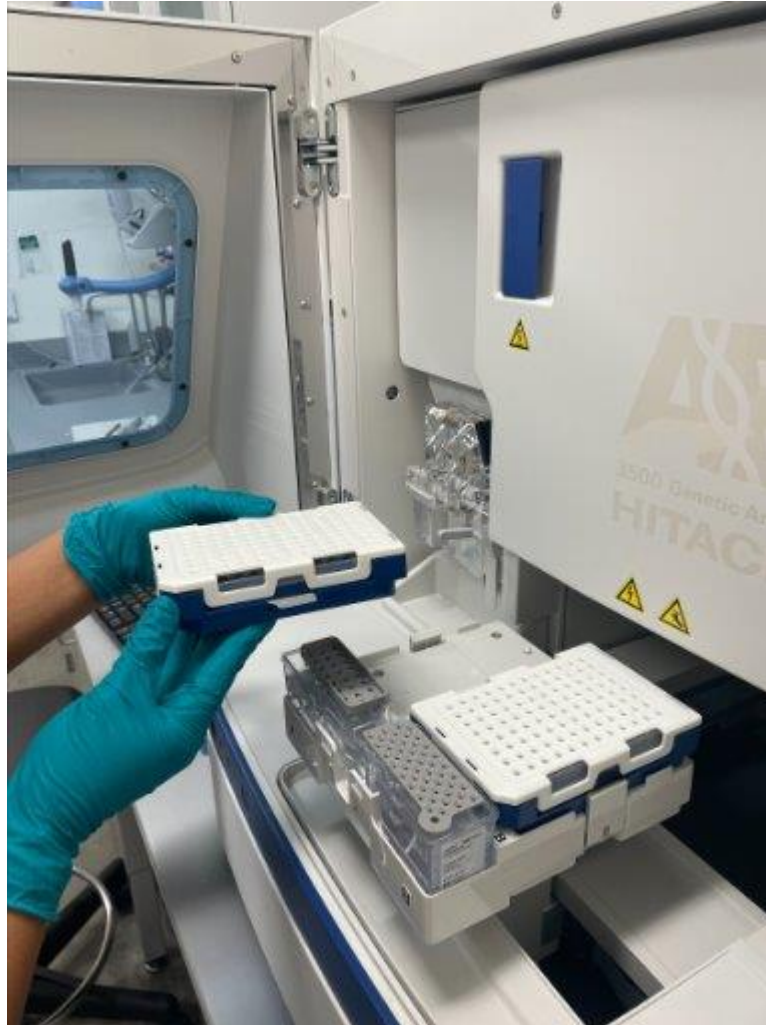
Lab knowledge and skills

Chromatography/ Separations

- GC
- LC
 - TLC
 - HPLC
 - UPLC
- CE

Spectroscopy

- FTIR
- Raman spectroscopy
- AAS
- MS
- ICP-MS
- XRF
- NMR



- **Gas Chromatography (GC)** - analytical technique used to separate, identify, and quantify volatile chemical compounds in a sample.
- **Liquid Chromatography (LC)** - powerful analytical technique used to separate, identify, and quantify components within a mixture.
- **Thin-Layer Chromatography (TLC)** - analytical technique that separates compounds in a mixture based on their differing affinities for a stationary phase and a mobile phase.
- **HPLC (High-Performance Liquid Chromatography)** is a powerful analytical technique that separates, identifies, and quantifies components within a liquid mixture by using a liquid solvent (mobile phase) to carry the sample through a packed column (stationary phase).
- **UPLC (Ultra Performance Liquid Chromatography)** is an advanced technique that builds upon High-Performance Liquid Chromatography (HPLC) by using stationary phase particles that are smaller than 2 μm .
- **Capillary Electrophoresis (CE)** - electrokinetic separation technique that uses an electric field to separate charged molecules within a narrow capillary tube filled with an electrolyte.
- **Fourier transform infrared spectroscopy (FTIR)** - technique used to obtain an infrared spectrum of absorption or reflectance of a solid, liquid, or gas.
- **Raman spectroscopy** is a technique based on inelastic scattering of monochromatic light.
- **Atomic Absorption Spectroscopy (AAS)** - analytical technique that uses the absorption of specific wavelengths of light by atoms in a gaseous state to determine the concentration of a particular element within a sample.
- **Mass spectrometry (MS)** - analytical tool useful for measuring the mass-to-charge ratio (m/z) and fingerprint of one or more molecules present in a sample.
- **Inductively coupled plasma mass spectrometry (ICP-MS)** - analytical technique that can be used to measure elements at trace levels in biological fluids and soils.
- **X-ray Fluorescence (XRF)** - powerful spectroscopy technique that allows for the detailed study of the elemental composition of various materials, providing valuable insights into their distribution and inter-element correlations.
- **Nuclear Magnetic Resonance (NMR) spectroscopy** - non-destructive analytical technique that uses a strong magnetic field and radio-frequency pulses to obtain detailed information about the structure, dynamics, and chemical environment of molecules.

Knowledge and skills

Presentation and public speaking

- Delivery
- Know your audience
 - Testimony vs. interview vs. conference presentation

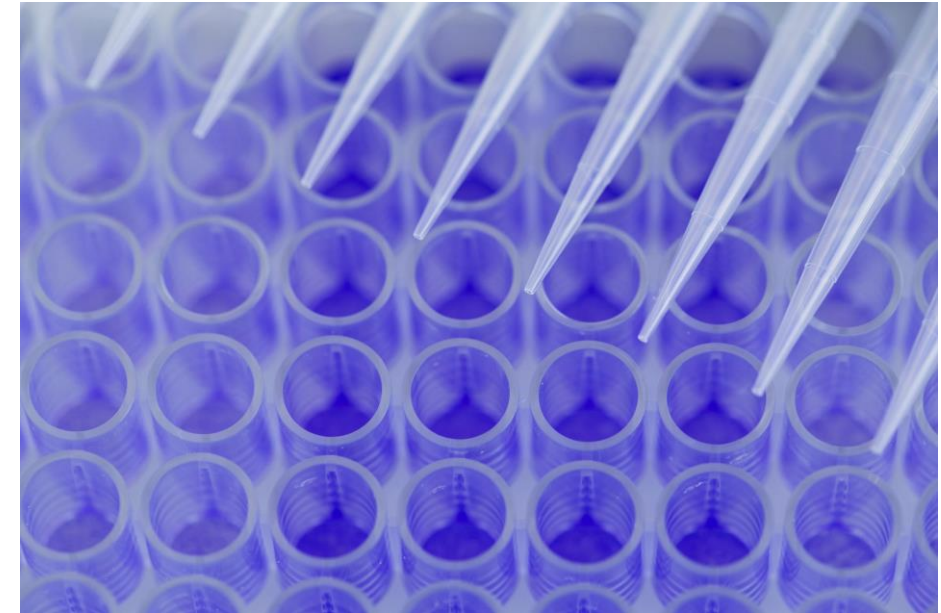
Written reports and communications

- Bench notes
- Report language and templates
- Scientific journal publication



Once you are hired

- Training
 - May last 3 mo. – 2 years
 - Highly technical
 - Includes lab history, policies and procedures, standards of testing
 - Lab shadowing and performance tasks
 - Knowledge-based assessment
 - Mock trial
- Demonstration of competency (see ASTM e2917)
- Evidence testing, interpretation and reporting
- Courtroom Testimony
 - May be once a year or less in some disciplines or multiple times a week in sections such as seized drugs



Standards can be used to guide policy and procedures.

ASTM International is a voluntary consensus standards development organization (SDO) that develops standards for a variety of products to keep consumers safe.

ANSI and ISO are the American National Standards Institute and International Organization for Standardization, other voluntary SDOs for products and processes.



Standards Development Organizations (SDOs)

- Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG)
- Scientific Working Group on DNA Analysis Methods (SWGDM)
- Organization of Scientific Area Committees for Forensic Science (OSAC)
- FBI National Quality Assurance Standards (QAS)
- Academy Standard Board (ASB)
- American National Standards Institute (ANSI)
- American Society for Testing Materials (ASTM)
- International Organization for Standardization (ISO)



ANSI/ASB 115 Knowledge-based Topics

- STRs
- PCR
- DNA Separation
- DNA Detection
- Instrumentation/Reagents
- Contamination
- QC
- Storage/Retention
- Troubleshooting

ANSI/ASB Standard 115, First Edition
2020

**Standard for Training in Forensic Short Tandem Repeat
Typing Methods using Amplification, DNA Separation,
and Allele Detection**

ANSI / ASB Standard 115, Standard for Training in Forensic Short Tandem Repeat Typing Methods using Amplification, DNA Separation, and Allele Detection, 1st ed. American Academy of Forensic Sciences. (August 2020). <https://www.aafs.org/asb-standard/standard-forensic-dna-analysis-training-programs>

<https://wp.towson.edu/dna-training-curriculum/curriculum/>

DNA TRAINING CURRICULUM

Curriculum for class or lab training

[HOME](#)

[DNA TRAINING CURRICULUM](#)

[ARTICLES AND PRESENTATIONS](#)

[ABOUT](#)

[CONTACT](#)

DNA Training Curriculum

Aligned to ANSI/ASB Standard 115

Expert Testimony

- Testify about the evidence evaluated, instrument(s) used, method, result, interpretation, report findings
- “Opinion” based on your education, training, experience, and scientific findings
- Be careful to not overstep your expertise
- If the question is beyond your area of expertise, say so



Characteristics of “good” forensic scientists

- Truthful
- Honest
- Thorough
- Ethical
- Reliable
- Diligent

