DNA Mixture Interpretation

The Maryland State Police Forensic Sciences Division Experience

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Best Practices in DNA Mixture Interpretation

- Two equally important parts to this process must be addressed

1) Establish best practices within your own DNA laboratory

2) Establish best practices within the DNA community

Personal Background

- AFDIL (1996 – 2000)
  - Mitochondrial DNA Tech
  - Nuclear DNA Tech
  - Mitochondrial / Nuclear DNA Analyst
- Delaware OCME (2000 – 2007)
  - DNA Technical Leader
  - DNA Unit Manager

Personal Background

- Maryland State Police (2007 – Present)
  - Biology Section Manager
  - Deputy Director
  - Director

Consequences of Changing Roles

- Follower to Manager to Leader
- Challenges for Lab Directors
  - Understanding today's casework
  - Staying current with the discipline
  - Relinquishing direct oversight
  - Trusting your team
  - Staying informed
  - Holding your team accountable

A Successful Strategy

- A Strong Technical Leader and Team
  - Dedicated technical unit (infrastructure)
  - Technical leader incentives
  - Picking the right team
  - Big picture (long term investment)

A Successful Strategy

- Research and Understand the Issues
  - Reading, seminars, webinars, etc.
  - Team must be willing to ask questions
  - Check pride at the door
  - Invest time upfront

A Successful Strategy

- Focus on Fundamentals
  - Understanding number of contributors
  - Understanding presence of genotypes vs. presence of alleles
  - Understanding what the stats mean
  - Understanding that stats don't drive interpretation
  - Understanding the difference between CPI and LR
  - Understanding that probabilistic genotyping is LR

A Successful Strategy

- Perform Validation Studies
  - Don't rely on simple studies for complex mixture interpretation validation
  - Generate multi-person mixtures
  - Create blind test mixtures (2nd person)
  - New protocol vs. Amended protocol
    - New – Create protocol using complex data
    - Amended – Test basic mixture protocol using complex data and amend as warranted

A Successful Strategy

- Adopt Standard Operating Procedures
  - SOPs are based on validation
  - SOPs are written for analysts
    - An analyst understands the science and validation behind the SOP
    - A technician follows a recipe
  - SOPs must be tight enough to prevent bad science but loose enough to address outlier cases
  - Ensure the SOP is re-evaluated as more casework data is generated

A Successful Strategy

- Train the Staff
  - Fundamentals, validations, SOPs
  - Simple and complex training samples
  - Real examples of issues/oddities
  - Sharing data
    - OK for teaching principles
    - Not OK for teaching interpretation protocol
  - Resistance or failure to grasp concepts may be overcome with bringing in an outside expert

A Successful Strategy

- Ensure Staff is Competent
  - Simple and complex competency tests
  - Interpretation evaluated
  - Use of Stats evaluated
  - Additional competency tests are needed as you bring on new tools or policies

A Successful Strategy

- Constant Exchange of Ideas
  - Prevent subgroups from developing
    - Random case reviews
    - Presentations of casework to the group
    - Presentations of workshop materials presented to the group
    - Webinars viewed by the group
  - Must be multi-directional
  - All participants must be open to giving and receiving input

A Successful Strategy

- Continue to Address Needs and Improve
  - Recognize need for review of analyst performance and additional training
    - Identified by supervisor/reviewer
    - Requested by analyst
  - Recognize need for review of protocols and additional validations
    - Responsibility of analysts, supervisors, manager, technical leader, and director

A Successful Strategy

- Pursue Future Implementation of Probabilistic Solutions
  - Move forward but don't skip the basics
  - Learn about all of the probabilistic tools
  - Seek out specific tools for specific needs
  - Evaluate the best fit for your specific lab (do not get pressured by sales people)
  - Next step for the Maryland State Police
    - LR calculations with probability of dropout
    - Identify cases that can benefit from commercially available probabilistic tools

Recent Incidents

- New York State Police Forensic Investigation Center
- Mixture interpretation competency test cheating*
  - We don't know all the details, but…
  - It is seems likely that a lack of understanding of the True Allele software played a role.

* Times Union (January 17, 2015)

Recent Incidents

- Washington D.C. Department of Forensic Sciences
- Mixture interpretation errors in casework*
  - We don't know all the details, but…
  - It seems likely that a lack of understanding of SWGDAM established best practices played a role

* Washington Post (March 5, 2015)

Wide Spread Problems

- Recent research shows that DNA mixture interpretation issues are common throughout the U.S.
  - NIST Mix13 Study
  - Defense Forensic Science Center's DNA Mixture Interpretation Study
- Directors should be concerned because continued misunderstandings are inevitable if this is not addressed now

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Questions???