

NATIONAL ACADEMY OF SCIENCES  
Committee on Law and Justice

Law Enforcement Use of Probabilistic Genotyping, Forensic DNA Phenotyping, and Forensic  
Investigative Genetic Genealogy Technologies

GENETIC PHENOTYPING

REBECCA BROWN  
MAAT STRATEGIES

INVESTIGATIVE TOOLS



SUSPECT DEVELOPMENT

# CONSIDERATIONS



ACCURACY  
EVALUATED IN THE  
LAB



ACCURACY IN REAL  
WORLD CASES



HOW ACCURACY IS  
UNDERSTOOD BY  
END USERS



HARMS



OPPORTUNITY  
COSTS

# ACCURACY IN THE LAB



- PRISTINE CONDITIONS OFFER LIMITED UTILITY
- BEFORE APPLIED TO ANY CASEWORK, MODELS SHOULD UNDERGO VALIDATION TO ASSESS THEIR ACCURACY ON SAMPLES FROM REAL WORLD CASES
- PHENOTYPING TESTS CANNOT PREDICT BODY CHOICES/MODIFICATIONS





# REAL WORLD APPLICATIONS OF LAW ENFORCEMENT TOOLS

- + degraded, low-quantity, complex mixtures
- + phenotyping has no bearing on when was DNA deposited
- + uncertain probabilistic inferences



# "An Investigative Tool"

## Some Philly-Area Police Departments Have Used DNA to Create CGI Sketches of Suspects

DNA phenotyping is part of a new wave of investigative tools for law enforcement. Critics dismiss it as "science fiction."

The Montgomery County DA's office said it disseminated the image of the suspect "in the hopes that someone might recognize him and contact detectives." But while the computer-generated mug shot produced multiple tips, none produced any legitimate leads.

## NYPD still using controversial DNA lab for investigations more than a year after City Hall said ties were cut

"...Howard Beach murder ... in 2016, where Black defendant ....was convicted of killing a white woman based in part on DNA testing. In that case, detectives demanded DNA swabs from hundreds of black and Hispanic men because they had been previously arrested in the area of the slaying.

They got information that a Black person committed the crime ... and what they did with that was go out and round up 500 Black men and take their DNA," the attorney said."

## EPS apologizes for releasing DNA phenotyping composite sketch of Black sexual assault suspect

EPS said Tuesday that it had never used phenotyping before, but that Calgary and Saskatoon police have used it in the past.

Police justified releasing the image because of the violent nature of the assault. "It was a vicious assault. Random stranger assault. And the survivor deserves justice, as well as the public," Det. Colleen Maynes, the officer in charge of the file, told reporters Tuesday morning.

Criticism of the use of phenotyping came swiftly. "The technology doesn't provide useful information beyond the stereotype..."



PRESUMPTIVE FIELD DRUG TESTS



## 2024 REPORT

### GUILTY UNTIL PROVEN INNOCENT: FIELD DRUG TESTS & WRONGFUL CONVICTION

Quattrone Center  
Penn Carey Law, University of  
Pennsylvania

- This year, **773,000 people will be arrested** based on field drug tests with known accuracy problems.
- **30,000 wrongful arrests** each year involve people who do not possess illegal substances
- **Black Americans** experience these erroneous drug arrests at **a rate 3x higher than white Americans.**





## Unreliable and Unchallenged

Years after the Las Vegas crime lab wanted to replace faulty police drug kits, they are still used in thousands of convictions.

by [Ryan Gabrielson](#)

Oct. 28, 2016, 11 a.m. EDT

CONTEXT IS  
EVERYTHING

USED WHEN OTHER, TRADITIONAL METHODS HAVE BEEN  
EXHAUSTED

ACCURACY  
IN REAL  
WORLD  
CONDITIONS

ADDS A VENEER OF SCIENCE TO UNRELIABLE IDENTIFICATION  
PROCEDURES

LIMITATIONS HANDLED THROUGH DISCLAIMERS/CAVEATS OR  
TRAINING

DAISY-CHAINED TO OTHER METHODS THAT HAVE NOT BEEN  
SUFFICIENTLY VALIDATED

HUMAN FACTORS: E.G., IMPLICIT BIAS: CONFIRMATION BIAS:  
TUNNEL VISION

ETHICAL, LEGAL, SOCIAL, EQUITY CONSIDERATIONS

A large, detailed fingerprint is visible in the background, with its ridges and valleys clearly defined. The fingerprint is centered and occupies most of the frame. Overlaid on the fingerprint are several semi-transparent rectangular boxes in shades of blue and purple, which serve as a backdrop for the text.

COLD CASE:

UNSOLVED CASE  
ABSENCE OF EVIDENCE  
MORE THAN TWO OLD

NO VIABLE LEADS

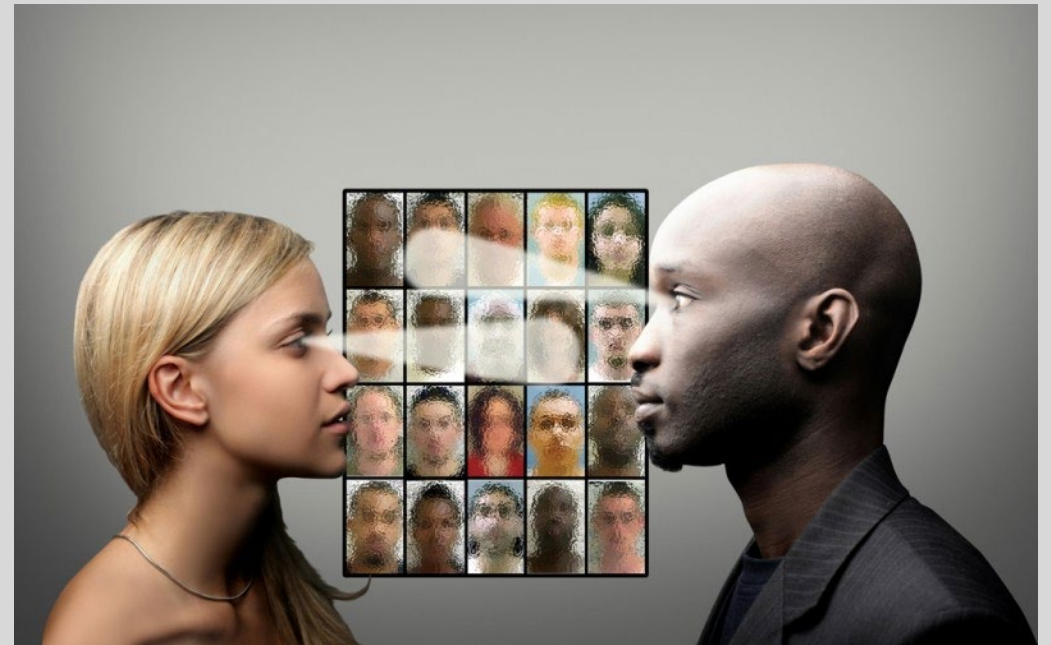






EYEWITNESS MISIDENTIFICATION

# CROSS-RACIAL IDENTIFICATION







# LAW ENFORCEMENT INTERPRETATION

# WARNINGS, INSTRUCTIONS, DISCLAIMERS & CAVEATS

**SURGEON GENERAL'S WARNING:**  
Quitting Smoking Now  
Greatly Reduces Serious  
Risks to Your Health.

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**SURGEON GENERAL'S WARNING:**  
Smoking Causes Lung Cancer,  
Heart Disease, Emphysema, And  
May Complicate Pregnancy.





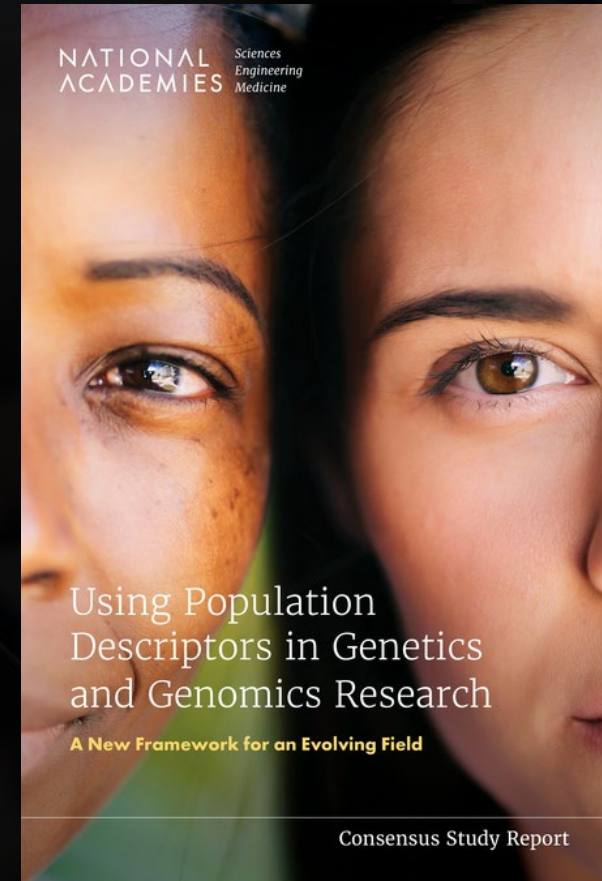
TRAINING



# POTENTIAL HARMS

*"Researchers have frequently used population descriptors as a shorthand for capturing the continuous and complex patterns of human genetic variation resulting from history, migration, and evolution."*

- DRAGNETS
- RACIAL PROFILING
- WRONGFUL ARREST & WRONGFUL CONVICTION
- MISDIRECTION OF INVESTIGATION
- DISPROPORTIONATE OUTCOMES IN COMMUNITIES OF COLOR
- REDUCING OR DEVASTATING COMMUNITY TRUST



A white calculator and a pen resting on a document with financial data, illustrating the concept of opportunity costs. The calculator is a standard desktop model with a large LCD screen and a numeric keypad. The pen is silver and black. The document in the background contains various financial figures and tables, including a table with columns for dates and amounts, and another table with columns for codes and amounts. The overall scene is a close-up, shallow depth-of-field shot, emphasizing the calculator and pen as tools for financial calculation and analysis.

# OPPORTUNITY COSTS



## **TAKEAWAYS**

- 1. THERE HAS BEEN NO FORENSIC VALIDATION IN REAL WORLD CASES (BUT THERE HAS BEEN EVIDENCE OF HARM IN REAL WORLD CASES)**
- 2. POLICE CANNOT AND SHOULD NOT BE EXPECTED TO DISCERN THE LIMITATIONS OF THIS TECHNOLOGY**
- 3. DISCLAIMERS AND TRAINING WILL NEVER ADDRESS THE VARIOUS HARMS GIVEN HUMAN FACTORS**