

## **PRECISION MEDICINE AND CONSUMER GENEALOGY DATA IMPACT FORENSIC GENOMICS: REIMAGINING DNA TYPING SUCCESS THROUGH NEXT GENERATION SEQUENCING AND SNP-BASED INVESTIGATIVE LEAD DATA**

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Forensic Genomics is actively experiencing a technology shift from STR only, CE-based methods to Next Generation Sequencing (NGS, MPS) of multiple marker types. Simultaneously, direct-to-consumer data sharing (e.g., ancestry.com, 23&Me, Helix) and personalized medicine increase availability of personal genomic data to enable better health care. This creates a crossroads for forensic genomics that invites us to reimagine technological advancements. Concepts presented here do not address policy or privacy issues; rather seek to inspire foundational thought regarding genetic investigative leads that can improve public safety as volumes of genetic sequencing data grow in the next 8-10 years.

Genetic investigative lead generation is primarily keeping pace with modern scientific advancements via two methods: 1) NGS to target forensically relevant loci, 2) SNP microarrays to genotype hundreds of thousands of single nucleotides. Two examples that are in limited practice today are highlighted for discussion:

- **Familial Searching:** Historically conducted within criminal databases bound by specific criteria (e.g., CODIS in the US). Over the past few years a handful of cases, including serial cold cases, have been aided or resolved via online familial DNA searching within publicly accessible genealogy databases. Interestingly, the same expansion of data availability that may increase privacy concerns can also alleviate concerns of falsely implicating an individual via eyewitness or other less conclusive leads.
- **Visible Trait & Biogeographical Ancestry Estimation:** NGS or SNP array generated data for phenotypic ancestry estimation do not require database searching, making them valuable for no suspect cases or when a CODIS hit is not made. Additionally, these data can steer investigations away from particular suspects, focusing resources in a prioritized manner. Today hair color, eye color and macro level ancestry groups are most widely used.

As no single genetic approach can fully resolve all persistent criminal investigation problems, a smart blend of approaches can be chosen for actionable investigative leads in specific cases. Impending advancements in personalized medicine anticipate an increase of human genomes that have been sequenced to rise from 1M to 2B by 2025, spurring a reimagining of applications and data utility that enable forward progress in a responsible manner.