

Aportes potenciales de la Genómica a la Identificación Humana desde el Instituto Nacional de Medicina Genómica (INMEGEN)

Simposio Internacional de Identificación Humana

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GOBERNACIÓN
SECRETARÍA DE GOBERNACIÓN



SALUD
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Instituto Nacional de
Medicina Genómica
MÉXICO

giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH



The National Institutes of Health



Instituto Nacional de Pediatría



INSTITUTO NACIONAL DE PERINATOLOGÍA
Isidro Espinosa de los Reyes



Instituto Nacional de Salud Pública



INSTITUTO NACIONAL DE NEUROLOGÍA Y NEUROCIRUGÍA



INSTITUTO NACIONAL DE CIENCIAS MÉDICAS Y NUTRICIÓN SALVADOR ZUBIRÁN

- 14 Institutes, each one dedicated to a particular Medical Specialty

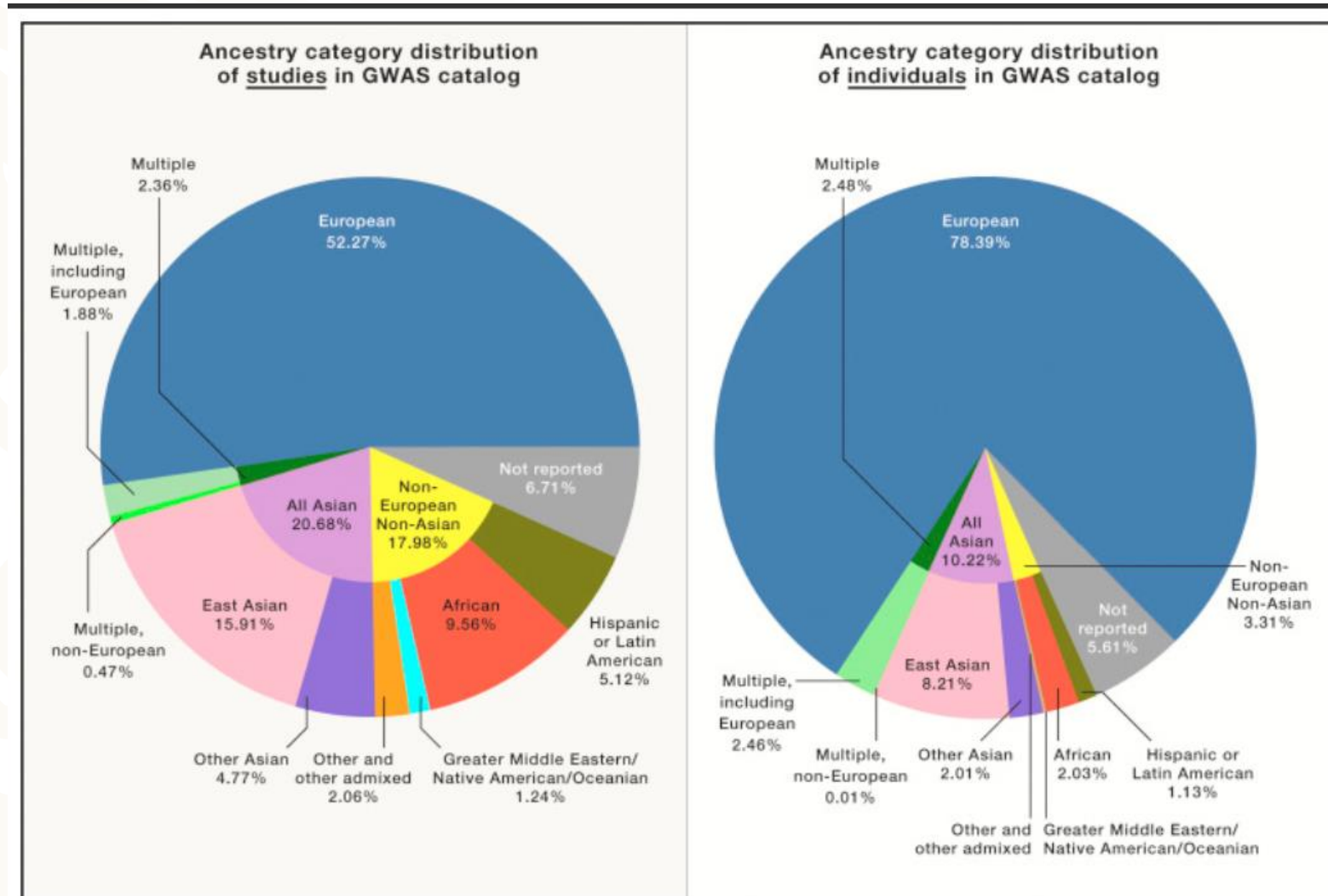
The National Institute of Genomic Medicine (INMEGEN)



- Created in 2004 as the 11th National Institute of Health in Mexico
- Apply genomic analysis tools in order to understand the genetic basis of common diseases, taking into consideration the genetic background and diversity of the Mexican Population



Challenge: Lack of Representation of Hispano-Latino Samples in Genomic Databases



¿How to Access the Benefits of Genomic Medicine in Diverse Populations?



CLOCKWISE FROM TOP LEFT: O. STREWE/LONELY PLANET IMAGES; A. DISSANAYAKE/LONELY PLANET IMAGES; K. COOLE/LONELY PLANET IMAGES; T. VOETEN/PANOS; R. IANSON/LONELY PLANET IMAGES; J. HAGLUND/LONELY PLANET IMAGES; P. ADAMS/GETTY IMAGES; C. CALVO VIA AP IMAGES

¿How to Apply Genomic Medicine in the Mexican Population?

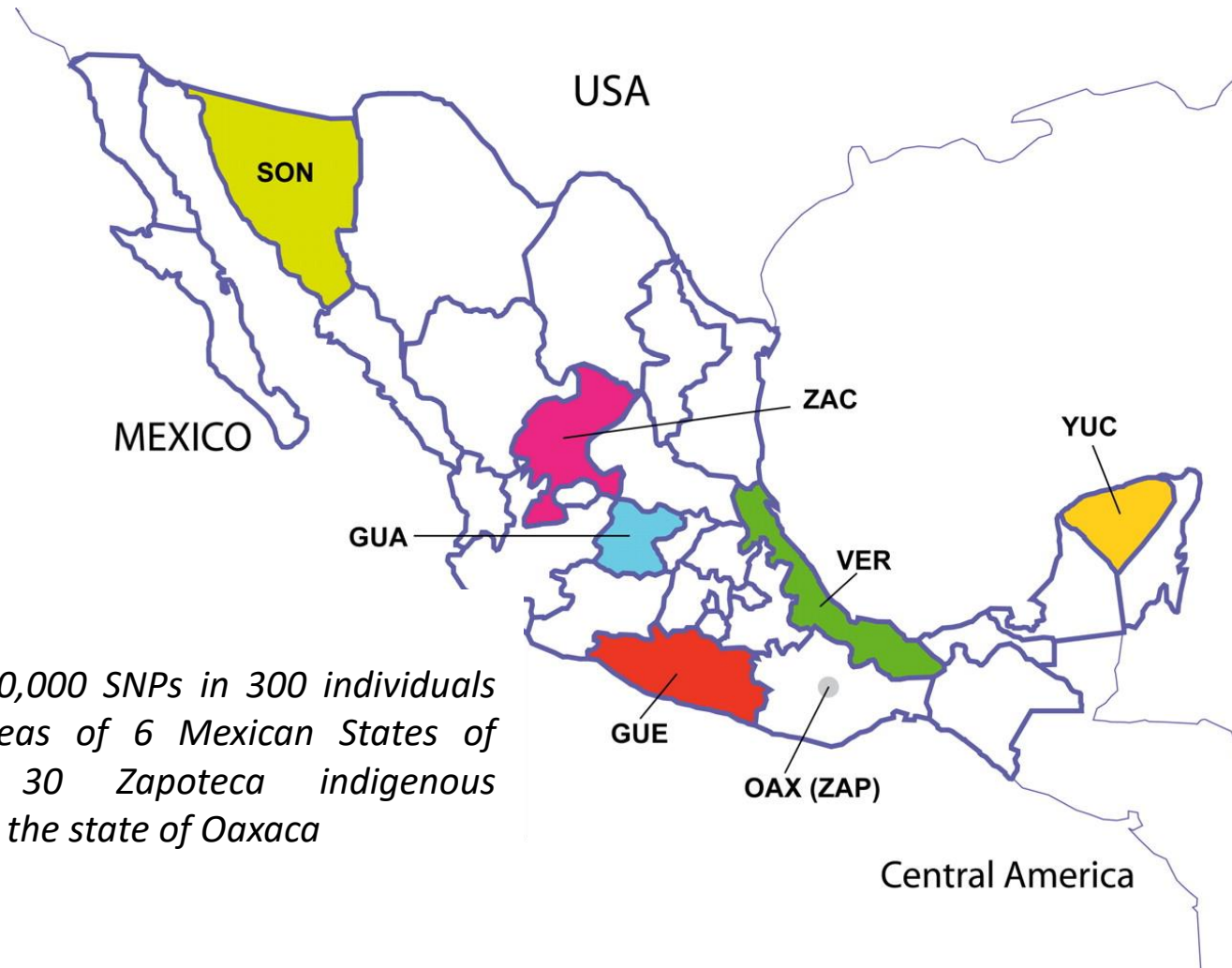


Analysis of Genomic Diversity in Mexican Populations





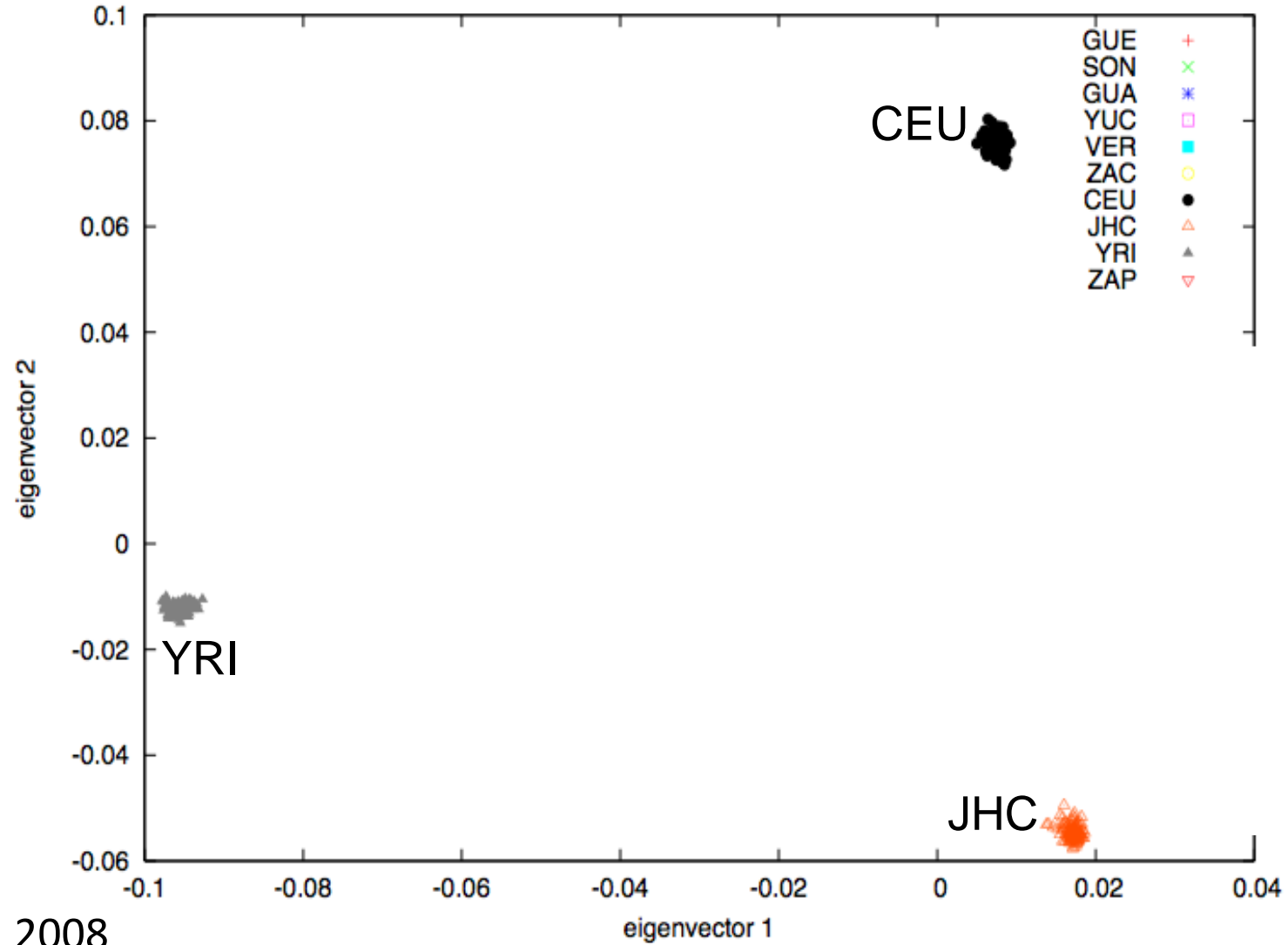
Phase I (2005-2009)



Analysis of 100,000 SNPs in 300 individuals from urban areas of 6 Mexican States of Mexico and 30 Zapoteca indigenous individuals from the state of Oaxaca

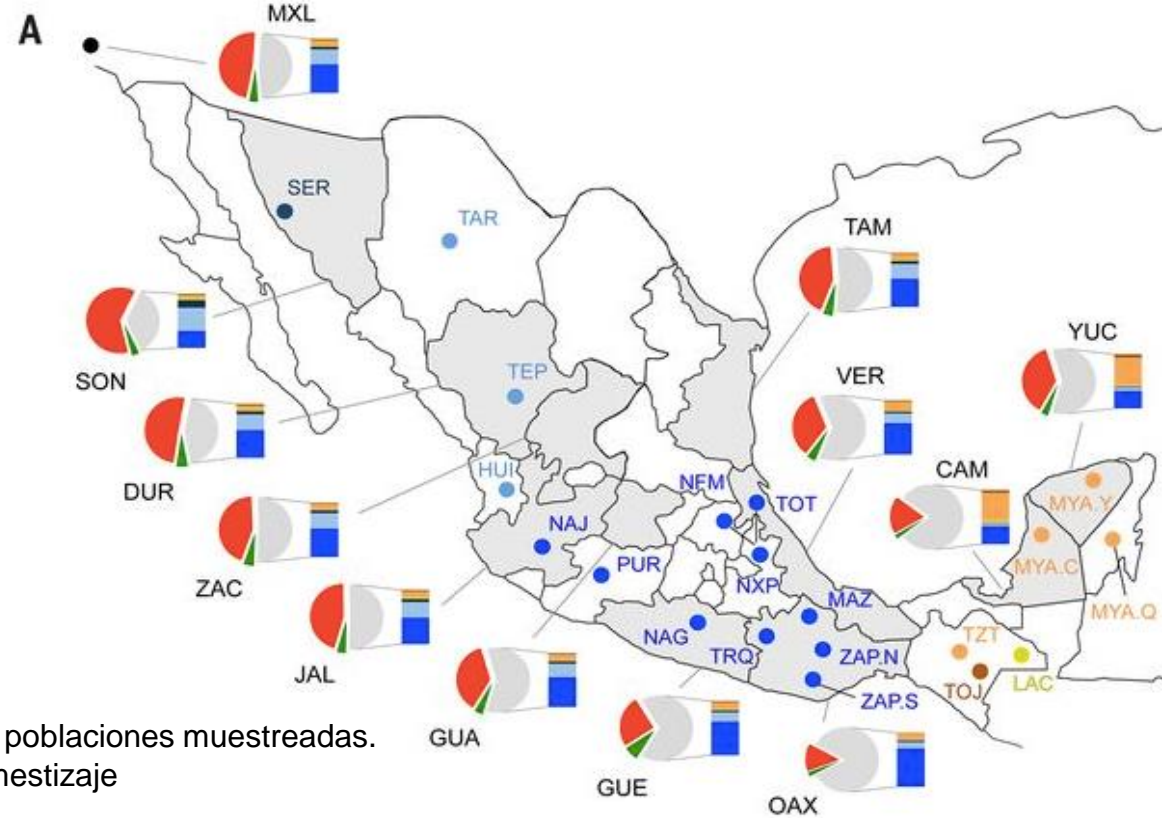
Analysis of genomic diversity in Mexican Mestizo populations to develop genomic medicine in Mexico

Irma Silva-Zolezzi¹, Alfredo Hidalgo-Miranda¹, Jesus Estrada-Gil¹, Juan Carlos Fernandez-Lopez, Laura Uribe-Figueroa,



Fase II (2009-2014)

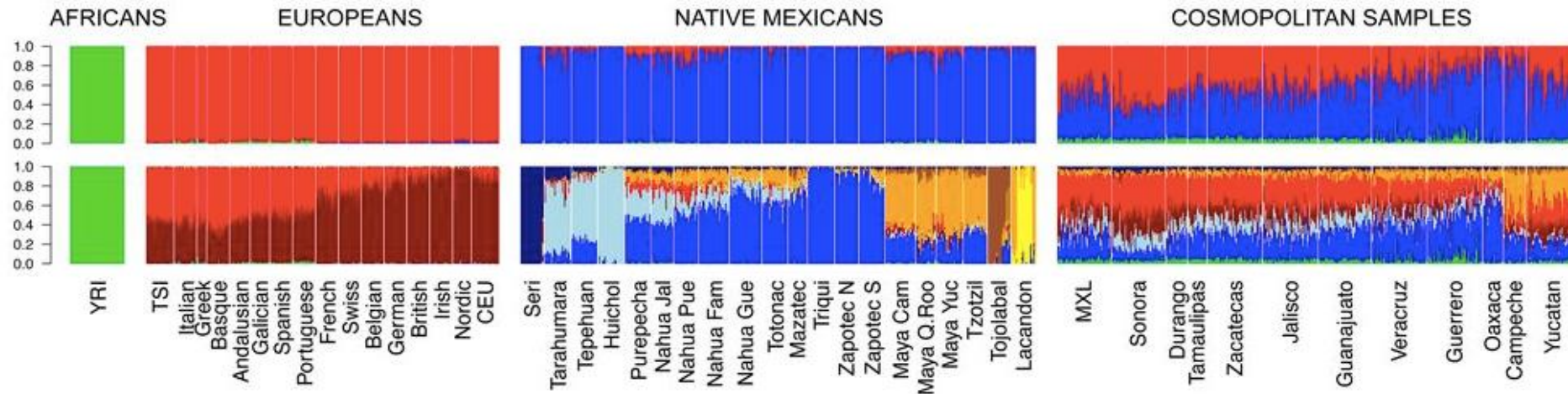
1 million SNPs
 500 individuals from 20
 Mexican Amerindian groups
 500 admixed individuals from
 11 Mexican States



Estructura de la población Mexicana. A) Mapa de poblaciones muestreadas.

B

B) Proporciones promedio de mestizaje



Applications in Population Genomics and Human Identification

Research article | [Open Access](#) | [Published: 08 January 2019](#)

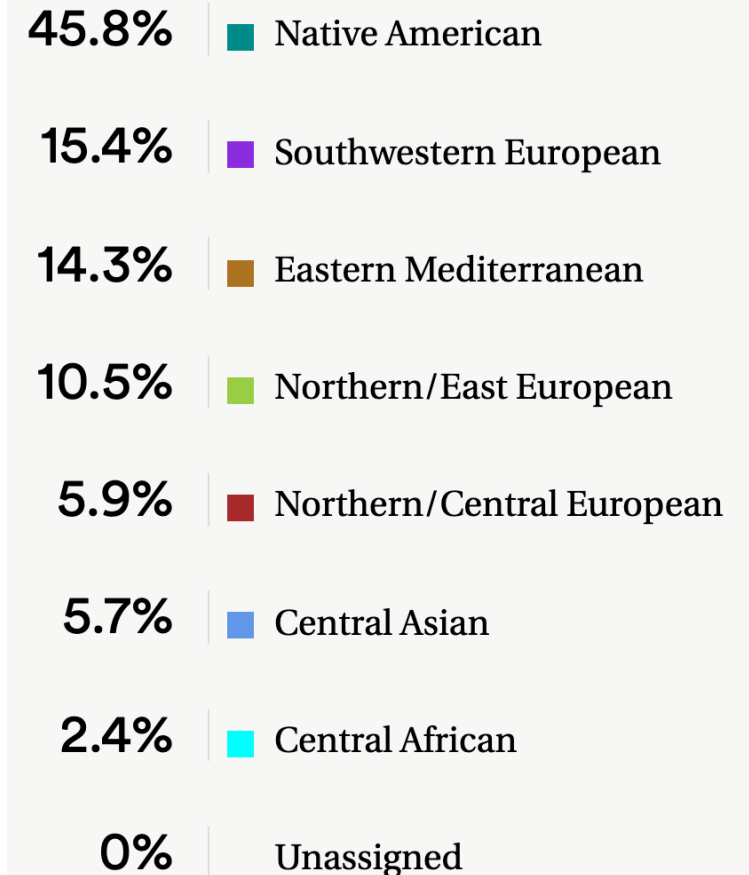
A panel of 32 AIMs suitable for population stratification correction and global ancestry estimation in Mexican mestizos

[Alicia Huerta-Chagoya](#), [Hortensia Moreno-Macías](#), [Juan Carlos Fernández-López](#), [María Luisa Ordóñez-Sánchez](#), [Rosario Rodríguez-Guillén](#), [Alejandra Contreras](#), [Alfredo Hidalgo-Miranda](#), [Luis Alberto Alfaro-Ruíz](#), [Edgar Pavel Salazar-Fernandez](#), [Andrés Moreno-Estrada](#), [Carlos Alberto Aguilar-Salinas](#) & [Teresa Tusié-Luna](#) [✉](#)

[BMC Genetics](#) 20, Article number: 5 (2019) | [Cite this article](#)



Your regions of ancestry



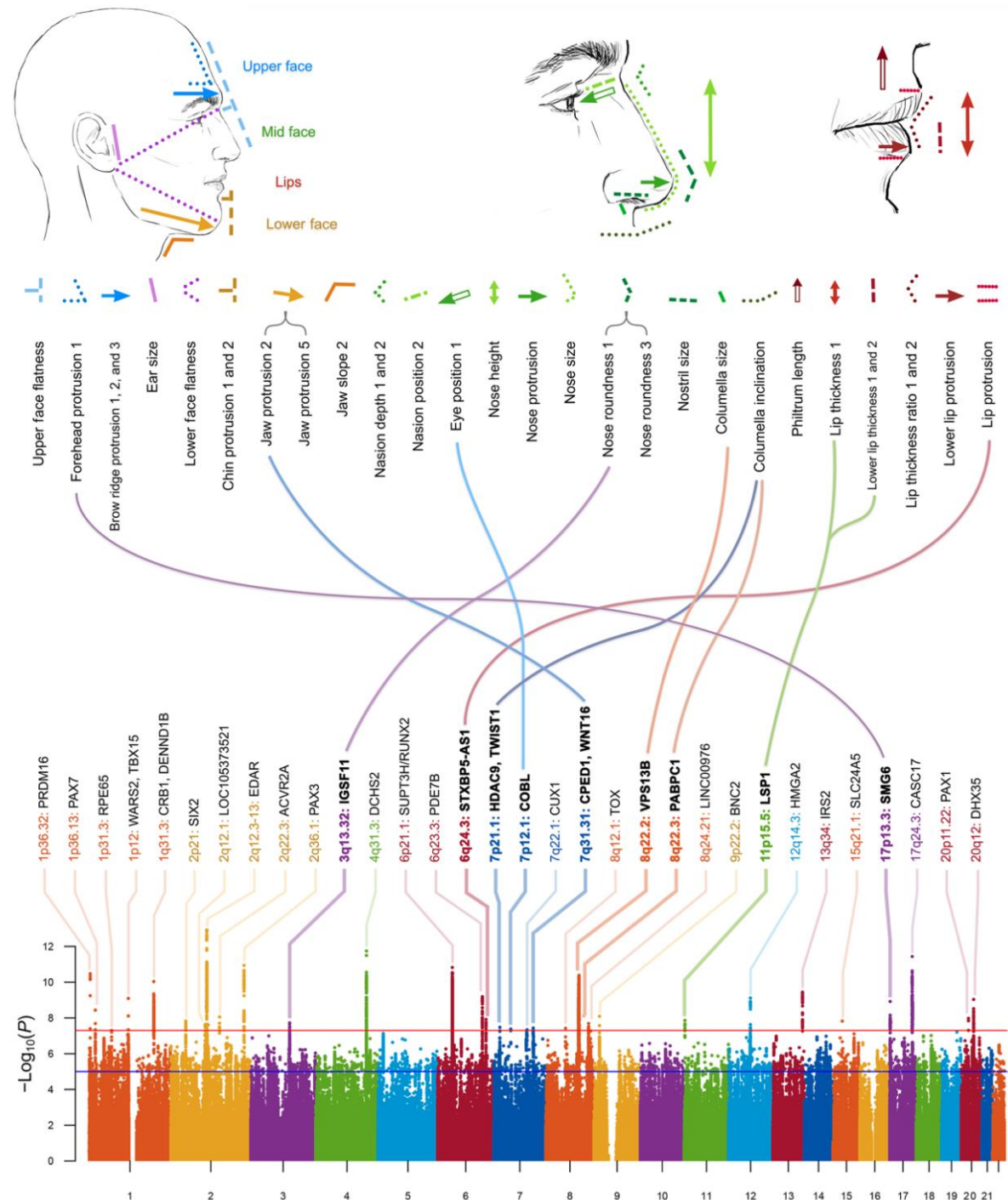
Genetic Markers Associated with Physical Traits: Face Shape

SCIENCE ADVANCES | RESEARCH ARTICLE

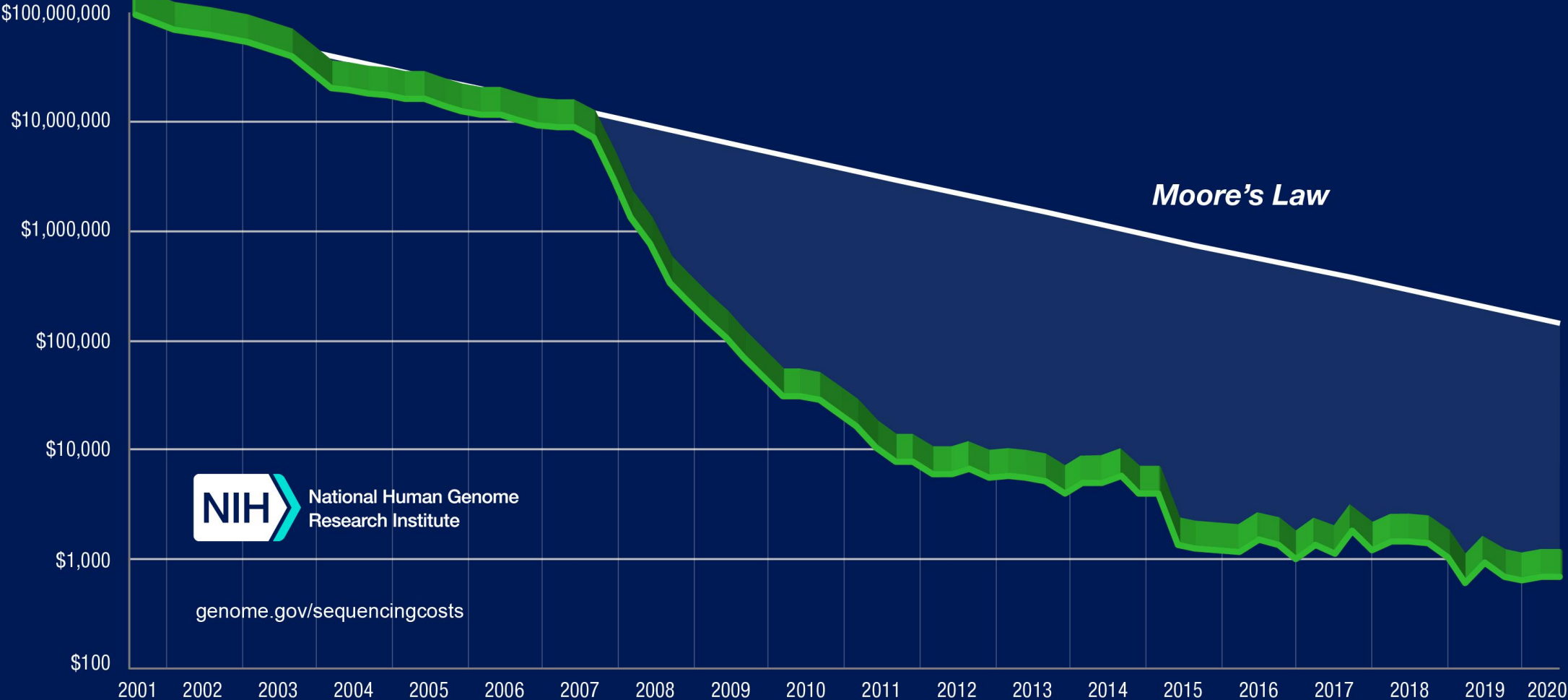
HUMAN GENETICS

A GWAS in Latin Americans identifies novel face shape loci, implicating VPS13B and a Denisovan introgressed region in facial variation

Bonfante *et al.*, *Sci. Adv.* 2021; **7** : eabc6160 5 February 2021



Cost per Human Genome



MPS Based Forensic Kits, STRs and More

Table 1. Forensic Loci Included in ForenSeq DNA Signature Prep Kit

Feature	Number of Markers ^a	Amplicon Size Range (bp)
Global Autosomal STRs	27	61–467
Y-STRs	24	119–390
X-STRs	7	157–462
Identity SNPs	95	63–231
Phenotypic SNPs ^b	22	73–227
Biogeographical Ancestry SNPs ^b	56	67–200

a. SNP and STR chromosome locations can be found in the ForenSeq DNA Signature Prep Kit User Guide (support.illumina.com/downloads/forenseq-dna-signature-prep-guide-15049528.html).

b. Two piSNPs used for hair/eye color are also used in the aiSNP marker set.

Applications of MPS in Human Identification



Human Identification
Identity, Kindship and Mixture Analysis
STRs, SNPs, MILs

Non Human Identification
Microbiome, Animal and
Plant Species Analysis
STRs, SNPs



Ancestry
Ethnic difference markers
Biogeographic origin and
Admixed population
SNPs (Indels, MHs)



Phenotype
Inference of external Visual
Skin, hair and iris Color,
baldness, Age and
Hair shape)
SNPs Analysis (Indels, MHs)



MicroRNA
Tissue Identification,
Post-Mortem Interval and
Prediction Stain Deposition Time
RNA Analysis



Epigenetics
Differentiation of Monozygotic Twins, Prediction of
Cronological Age, Identification of Tissue (Saliva, Blood,
Semen), Habitual Behaviours and Drugs Consumption.
DNA methylation Analysis



Accuracy

Prediction

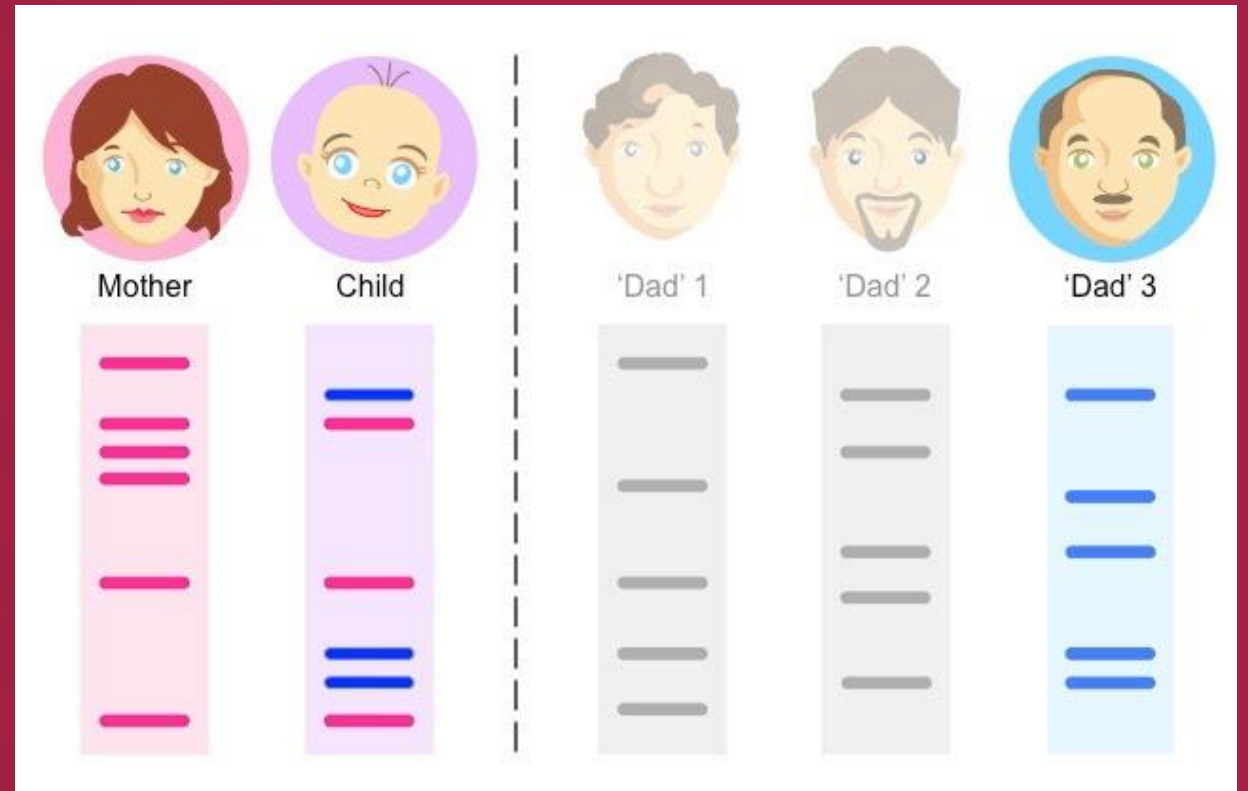


Epigenetics

**NEXT
GENERATION
SEQUENCING**

Human Identification: The Diagnostic Genomics Lab

- STRs tests for paternity testing
- Between 5-10 trios daily
- All equipment for DNA extraction from FTA and other tissues
- Capillary electrophoresis



Equipment for High-Throughput DNA Analysis from Diverse Sample Types

- Automated DNA extraction from routine samples (blood, FTA blood card, tissue, buccal swabs)
- Capillary DNA sequencers validated for Human Identification analysis (STRs)
- Variety of massive parallel sequencing platforms (Illumina, Thermo, Oxford Nanopore)
- Bioinformatic capabilities and infrastructure for database storage and management

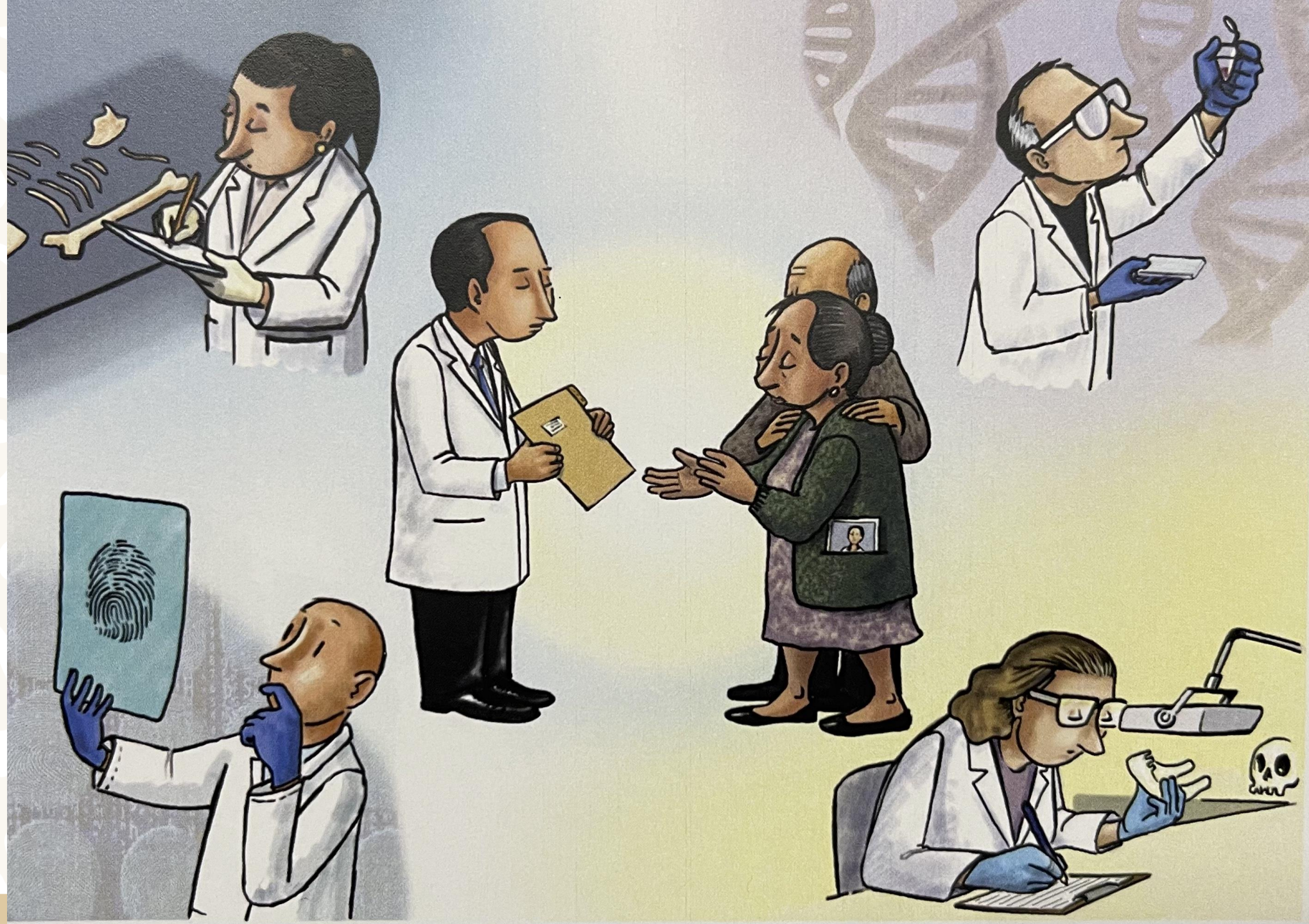
How can we help??



- **Installed infrastructure and skilled personnel in molecular biology methods**
- **Capacity for High-throughput genetic and genomic analysis**
- **Solid research lines in population genomics, focused on the particular characteristics of the Mexican Population**
- **Space and resources to create a state of the art Forensic Genomics Laboratory**
- **Established methods for STR analysis in a diagnostic setting**

Do not leave anyone behind, do not let anyone outside...





¡GRACIAS!



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