

Introduction to Population Genetics Theory

Loic Yengo, PhD

Institute for Molecular Bioscience

The University of Queensland

l.yengo@imb.uq.edu.au



Population Genetics Theory is concerned with characterizing and quantifying **genetic variation** within and between **populations**.

What is a Population?



“All inhabitants of particular place” – Oxford dictionary

[BIOLOGY] – “A community of animals, plants, or humans among whose members interbreeding occurs” – Oxford dictionary

“Any complete group with at least one characteristic in common” – Australian Bureau of Statistics

“All the inhabitants of a country, territory, or geographic area, total or for a given sex and/or age group, at a specific point of time. In demographic terms it is the total number of inhabitants of a given sex and/or age group that actually live within the border limits of the country, territory, or geographic area at a specific point of time, usually mid-year. The mid-year population refers to the actual population at July 1st.” – World Health Organization

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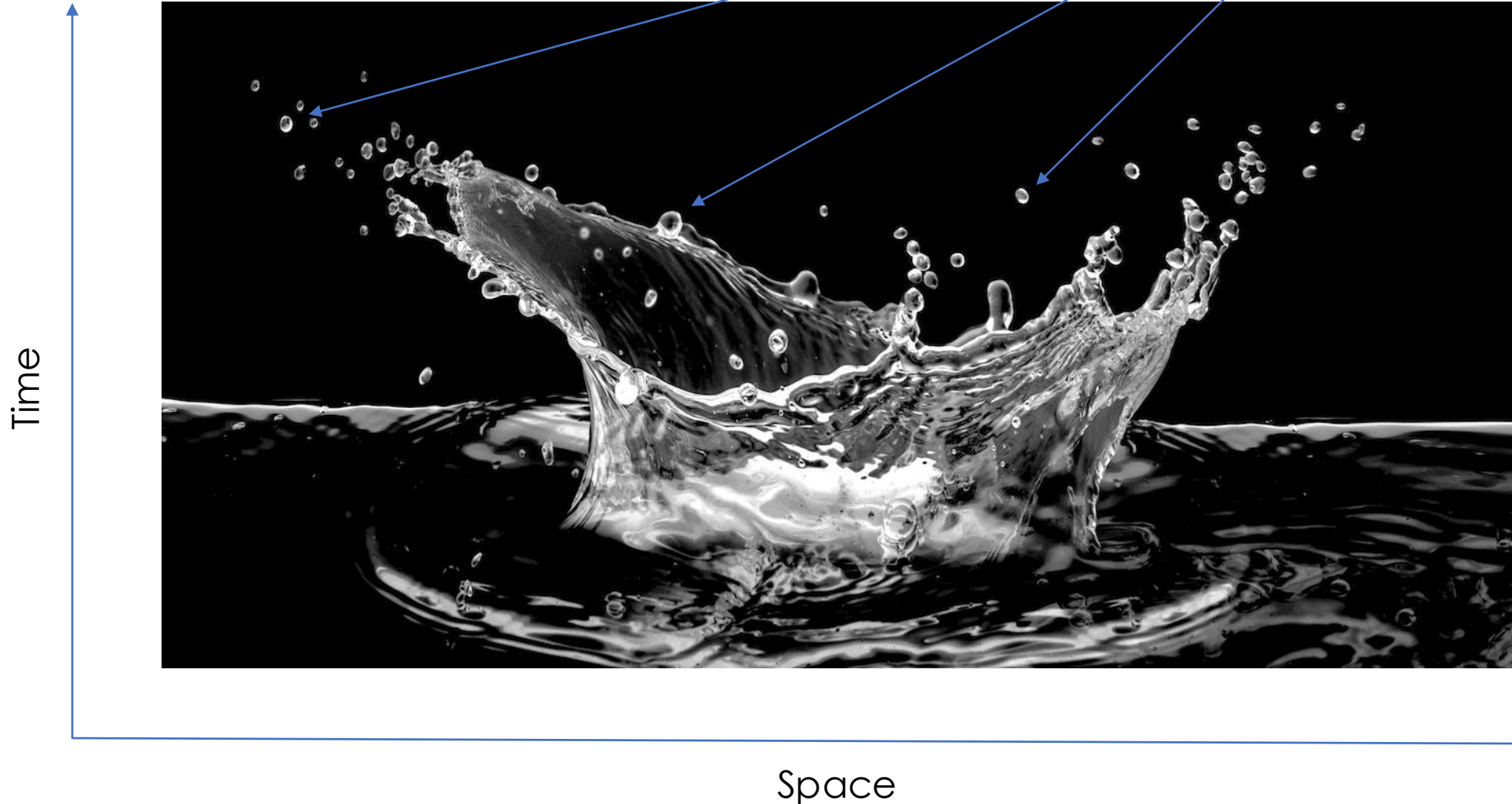
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“All the inhabitants of a **country, territory, or geographic area**, total or for a given sex and/or age group, at a specific point of time. In demographic terms it is the total number of inhabitants of a given sex and/or age group that actually live within the border limits of the country, territory, or geographic area **at a specific point of time**, usually mid-year. The mid-year population refers to the actual population at July 1st.” – *World Health Organization*

A population is a concrete abstraction...

1. Population = Group of individuals
2. Who is *inside* or *outside* is arbitrary, i.e., depends on your research question

Are these drops from the same population?



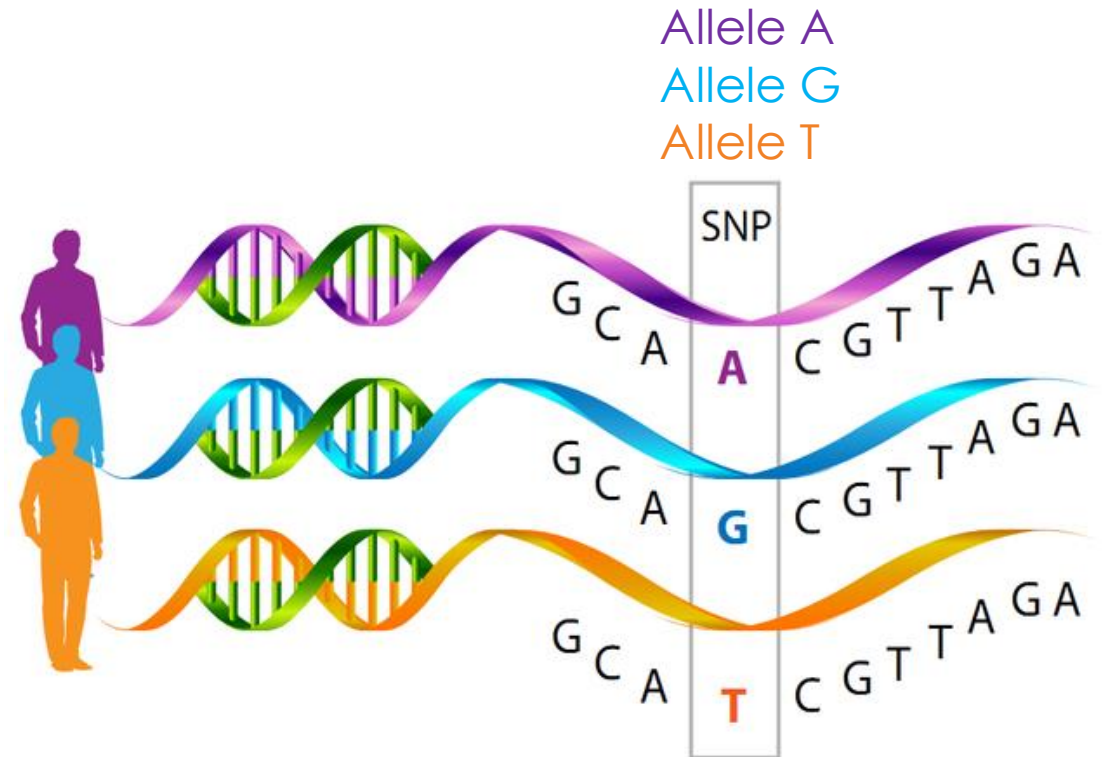
What is Genetic Variation?



Genetic variation...

There is a near infinite number of ways to measure a distance between DNA sequences of two individuals

- (1) Number of repeats
- (2) Inversions
- (3) Deletions
- (4) Single letter (nucleotide) changes
- (5) ...



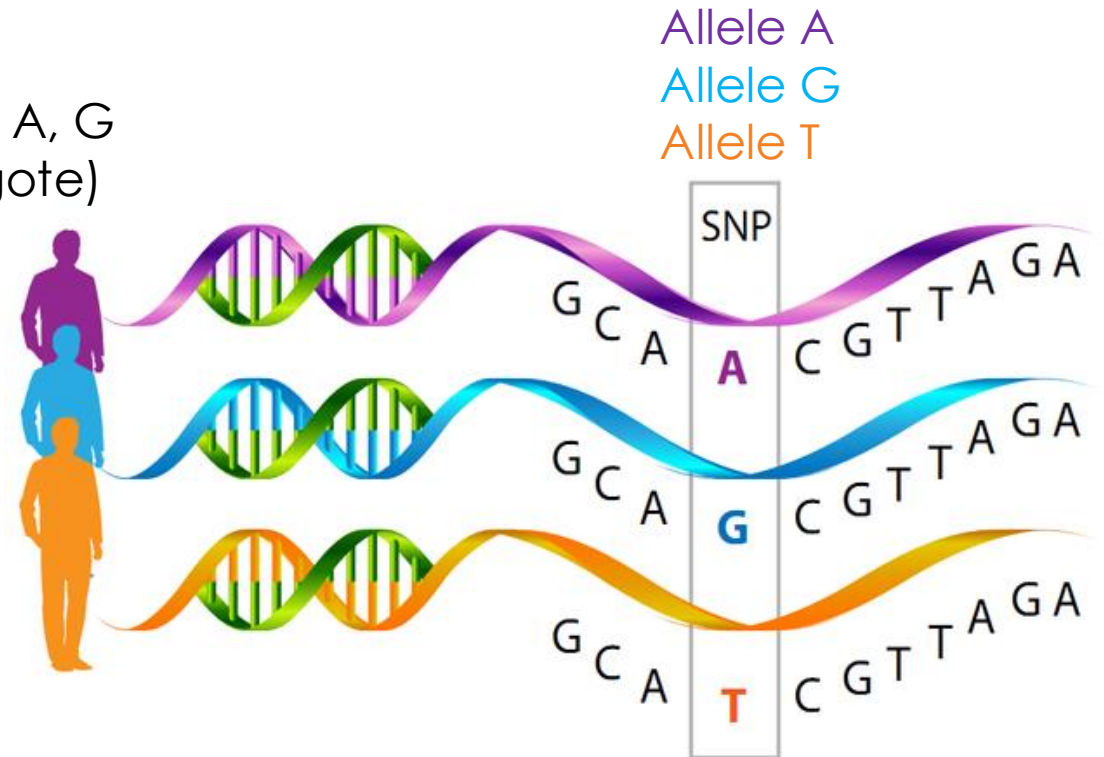
Single Nucleotide Polymorphisms

Definitions

Allele = possible state of the DNA sequence at a given locus.

Genotype = defined by the states of all alleles at the locus.

Examples: In a diploid individual. If there are three alleles A, G and T, then possible genotypes are AA, GG, TT (homozygote) and AG, AT, GT (heterozygote)



Single Nucleotide Polymorphisms

Population Genetics Theory is the theory of **alleles and genotypes frequencies** within and between **groups of individuals**.

Outline

- Hardy-Weinberg Equilibrium
- What drives changes in allele/genotype frequencies?
- How can you measure genetic distance between populations?
- Linkage Disequilibrium

Learn more: <https://www.colorado.edu/ibg/isg-workshop/isgw-online-resources/2-introduction-population-genetics>