

The Role of Genomics in Canada's Future Forests

Vocabulary List

Allele(s): a particular version and/or variation of a gene.¹

Heritable variation:

- a) heritable/heredity: referring to traits that can be transmitted from one generation to the next/the transmission of traits from parents to offspring via genetic information.¹
- b) genetic variation that can be passed on to the next generation.

(DNA) sequencing/sequence: determining the order of the four chemical building blocks (DNA base pairs, A/T/G/C) that make up DNA molecules. The sequence is a portion of DNA base pairs in a specific order which determines the kind of genetic information that is carried in a particular DNA segment.²

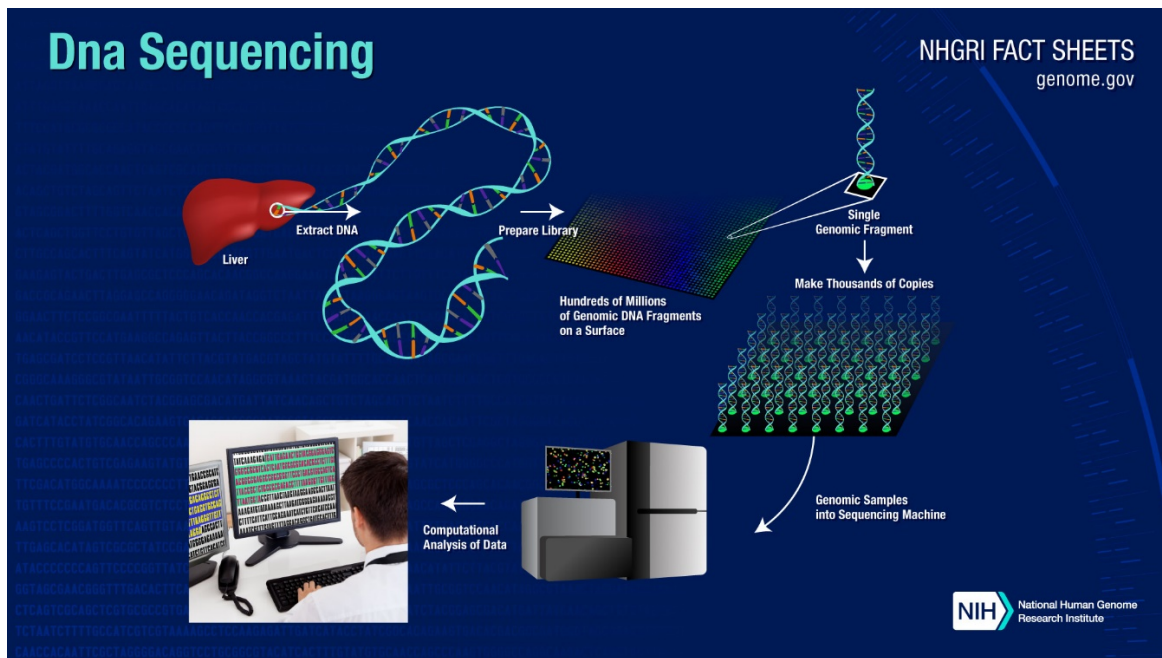


Fig 1. The start to finish process of DNA sequencing.²

Amino acid(s): a small organic molecule with a central carbon atom bonded to an amino group ($-\text{NH}_3$), a carboxyl group ($-\text{COOH}$), a hydrogen atom, and a side group. Proteins are polymers of 20 common amino acids, i.e. amino acids are the 'building blocks of life'.¹

Reference genome:

- a) a digital nucleic acid sequence database, assembled by scientists as a representative example of the set of genes in one idealized individual organism of a species.³
- b) a haploid mosaic of different DNA sequences from individual donors; there are reference genomes for viruses, bacteria, fungus, plants, and animals.³
- c) a baseline genome that guides scientists to assemble the fragments of newly sequenced genomic material in a biologically accurate order.

Illumina sequencing:

- a) a high-throughput—quickly generates millions of highly accurate DNA sequence reads—cost-effective DNA sequencing technology used to sequence genomes and subsequently allow comparison of assembled genomes.⁴
- b) a type of DNA sequencing method that requires DNA samples to be broken up into small fragments before being processed in specialized machines.⁴

PacBio sequencing:

- a) also known as Single Molecule Real-Time (SMRT) Sequencing, is a long-read DNA sequencing method that does not require DNA to be broken up into fragments as it can process DNA segments that are tens of kilobases in length to readily assemble complete genomes.⁵
- b) a type of DNA sequencing method that sequences full-length transcripts with high accuracy and uniform coverage.⁵

Bioinformatics: the field of study concerned with managing, analyzing, and interpreting biological information, particularly DNA sequences.¹

Genomics: the field of study concerned with sequencing, interpreting, and comparing whole genomes from different organisms.¹

Evolution:

- a) the theory that all organisms on Earth are related by common ancestry and that they have changed over time, predominantly via natural selection.¹
- b) any change in genetic characteristics of a population over time, especially a change in allele frequencies.¹

(Genetic) adaptation: any heritable trait that increases the fitness of an individual with that trait, compared with individuals without that trait, in a particular environment.¹

Common garden (experiment): also known as a transplant experiment; an experiment to test the effect of the environment by moving two or more species from their native/origin environments into a common environment. In a forestry context, seeds are often collected from a single tree species throughout its range and planted in a common environment to analyze genetic adaptation and variation within the species, or foresters use common garden experiments to test multiple tree species adaptation to determine where they should be planted as the climate changes. These experiments are a classical way to test if there is a genetic component to differences in traits within and among populations.⁶

Phenotype(s):

- a) the detectable physical and physiological traits of an individual, which are determined in its genetic makeup.¹
- b) the specific trait associated with a particular allele.¹

Exome(s): the part of the genome that consists of exons. Exons are the portion of the gene that is expressed and codes for amino acids.^{7,8}

Sequence capture: a technology that allows for targeted enrichment of specific regions of a genome, such as an entire exome. It is used with next-generation sequencing methods to efficiently analyze targeted regions of interest within a genome.⁹

Ecosystem value(s): economic and philosophical measures of how important ecosystem services are to people.¹⁰

Adaptive trait(s): a genetic trait that helps an organism to maximize its reproductive success/fitness.¹¹

Mixed planting(s): the planting of two or more tree species throughout a landscape to create a heterogeneous forest stand.



References

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