Methods For Measuring Telomere Length

Tech ID: 34864 / UC Case 2024-772-0

BACKGROUND

Telomeres are the end of eukaryotic chromosomes and shorten with time. Shortened telomeres cause disease in patients with short telomere syndromes. Cancer cells must activate telomerase to maintain telomeres to overcome senescence or apoptosis due to critically short

telomeres.

Telomere length is often measured by Southern Blot (invented in 1973). This method measures the length of all the telomeres in the cell and does not give quantitative information or information about individual telomere lengths. A quantitative PCR method was developed however it has many problems with reproducibility across different labs. The Single Telomere Length Analysis (STELA) method and the related Telomere Shortest Length Assay (TeSLA) targets individual telomeres, but the use of high cycles of PCR generates bias for shorter products.

Additionally, the use of Southern Blotting in STELA and TeSLA makes these techniques laborious and low-throughput. Currently, Telomere Flow FISH is the accepted clinical method for measuring telomere length. This method is highly reproducible, and can report on a specific cell type, however

it requires fresh blood samples and is not able to measure archival samples or tissues other than blood. The method uses an average of the telomeres without the ability to report the individual lengths of telomeres.

Thus, there are currently no methods that provide an accurate, high throughput, and simple approach for quantifying telomere length.

TECHNOLOGY DESCRIPTION

Nobel Laureate Carol Greider and her team invented the TeloTag technique which enriches telomeric DNA for nanopore sequencing. This has allowed for exceedingly accurate determination of telomore length and

CONTACT

Jeff M. Jackson
jjackso6@ucsc.edu
tel: .

INVENTORS

- Greider, Carol W.

OTHER INFORMATION

KEYWORDS

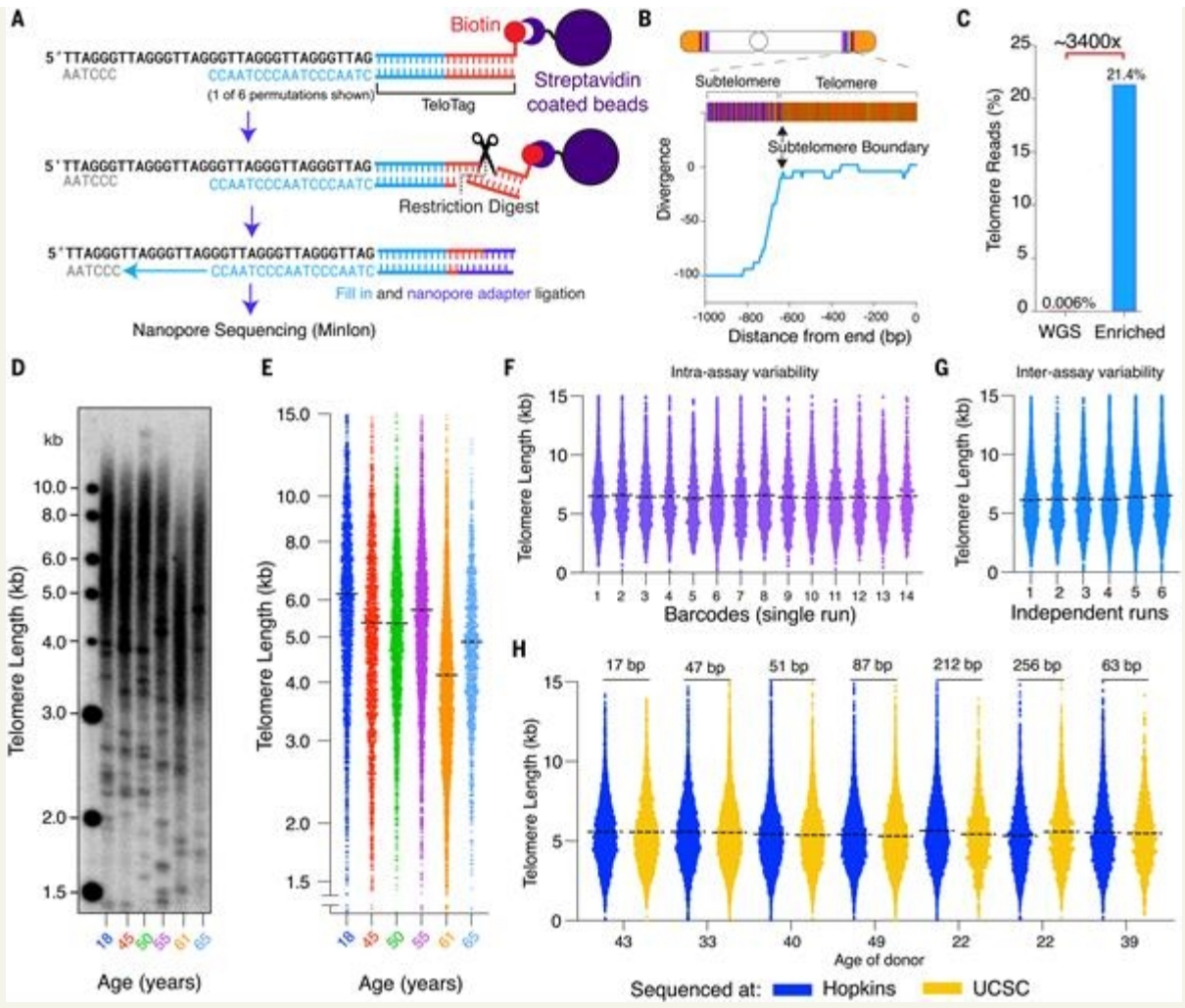
telomeres, telomere length, nanopore sequencing, long read sequencing, TeloTag, telomere sequence enrichment

CATEGORIZED AS

- **Biotechnology**
  - Genomics

RELATED CASES

2024-772-0

composition. 

A telomere tagging probe with a biotin adapter is contacted with a splint oligonucleotide that binds to both a telomere and the telomere tagging probe.

The telomere tagging probe is ligated the telomere to generate a tagged telomere sequence and tagged telomere sequence is conjugated to a streptavidin functionalized via a biotin adapter on the tagged telomere sequence.

The bead is isolated and the tagged telomere sequence is recovered. The tagged telomere sequence can then by analyzed by any of a number of methods to determine the telomere length.

The above figure depicts the following:

(**A**) Schematic depicting the Telomere Profiling enrichment method. Telomeres are tagged with a biotin adapter (TeloTag), enriched by streptavidin pull-down, and sequenced. (**B**) Subtelomere boundary is identified using an algorithm, TeloBP, that detects substantial deviation from the telomere repeat pattern. (**C**) Comparison of Telomere Profiling versus whole genome sequencing (WGS). (**D**) Southern blot of telomere lengths from six individuals of different age. (**E**) Telomere length measured by Telomere Profiling for the same individuals as in (C) (total reads = 21,556). The dashed line represents the median telomere length of each distribution. Each point represents a single telomere read. (**F**) Intra-assay variability: Telomere length from a single donor was measured 14 times on a single flow cell (total reads = 13,256). (**G**) Interassay variability: Telomere length measured from a single donor across six different flow cells (total reads = 19,230). (**H**) Telomere length profiles from the same samples generated in two different laboratories, Johns Hopkins University (blue) and the University of California, Santa Cruz (gold). The difference in telomere length in base pairs is shown at the top.

Karimian et al, Science 384, 6695 533-539 (2024)

APPLICATIONS

Genomic sequencing

Diagnosing diseases involving telomere length

Studying telomerase enzyme in cellulo and in vivo

ADVANTAGES

Highly accurate, rapid, repeatable, and easy to perform.

Works well with nanopore sequencing

INTELLECTUAL PROPERTY INFORMATION

Country	Type	Number	Dated	Case
European Patent Office	Published Application	4581367	07/09/2025	2024-772

Additional Patents Pending

RELATED MATERIALS

- Human telomere length is chromosome end–specific and conserved across individuals - 04/11/2024
- Chromosome-specific telomere lengths and the minimal functional telomere revealed by nanopore sequencing - 10/26/2021

University of California, Santa Cruz
Industry Alliances & Technology Commercialization
Kerr 413 / IATC,
Santa Cruz,CA 95064

Tel: 831.459.5415
innovation@ucsc.edu
https://officeofresearch.ucsc.edu/
Fax: 831.459.1658