Extension of Telomeres


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Introduction

Reactome is open-source, open access, manually curated and peer-reviewed pathway database. Pathway annotations are authored by expert biologists, in collaboration with Reactome editorial staff and cross-referenced to many bioinformatics databases. A system of evidence tracking ensures that all assertions are backed up by the primary literature. Reactome is used by clinicians, geneticists, genomics researchers, and molecular biologists to interpret the results of high-throughput experimental studies, by bioinformaticians seeking to develop novel algorithms for mining knowledge from genomic studies, and by systems biologists building predictive models of normal and disease variant pathways.

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Literature references


Reactome database release: 77

This document contains 3 pathways (see Table of Contents)
Extension of Telomeres

**Stable identifier:** R-HSA-180786

**Compartments:** nucleoplasm

Telomerase acts as reverse transcriptase in the elongation of telomeres (Smogorzewska and de Lange 2004).

**Literature references**


**Editions**

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Humans, like most eukaryotic organisms, add direct repeats to the telomere using a specialized DNA polymerase called telomerase. Telomerase is a ribonucleoprotein (RNP) complex minimally composed of a conserved protein subunit containing a reverse transcriptase domain (human telomerase reverse transcriptase, hTERT) and a template-containing RNA (human telomerase RNA component, hTERC, or hTR, hTER). The primer for telomerase is the G-rich single-strand overhang at the chromosome end.

Telomerase can perform multiple rounds of repeat synthesis. The reaction cycle has been inferred from in vitro studies of telomerase from multiple organisms and can be described as having four events: 1) DNA primer recognition, 2) RNA template alignment, 3) elongation, and 4) translocation. Telomeric DNA is recognized in part by a presumed "anchor site" in hTERT, which preferentially binds G-rich DNA, and this interaction can affect elongation and translocation steps. This interaction occurs 5' of the alignment of the RNA template with the end nucleotides of the chromosome. RNA alignment positions the template adjacent to the chromosome terminus. During elongation, the template directs sequential addition of nucleotides to the telomere end. After synthesis of a repeat is completed, relative movement of telomerase and the primer, termed translocation, repositions telomerase at the end of the newly added sequence to allow initiation of another round of repeat addition.

Literature references


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Telomere C-strand (Lagging Strand) Synthesis

Location: Extension of Telomeres

Stable identifier: R-HSA-174417

Compartments: nucleoplasm

Due to the antiparallel nature of DNA, DNA polymerization is unidirectional, and one strand is synthesized discontinuously. This strand is called the lagging strand. Although the polymerase switching on the lagging strand is very similar to that on the leading strand, the processive synthesis on the two strands proceeds quite differently. Short DNA fragments, about 100 bases long, called Okazaki fragments are synthesized on the RNA-DNA primers first. Strand-displacement synthesis occurs, whereby the primer-containing 5'-terminus of the adjacent Okazaki fragment is folded into a single-stranded flap structure. This flap structure is removed by endonucleases, and the adjacent Okazaki fragments are joined by DNA ligase.

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