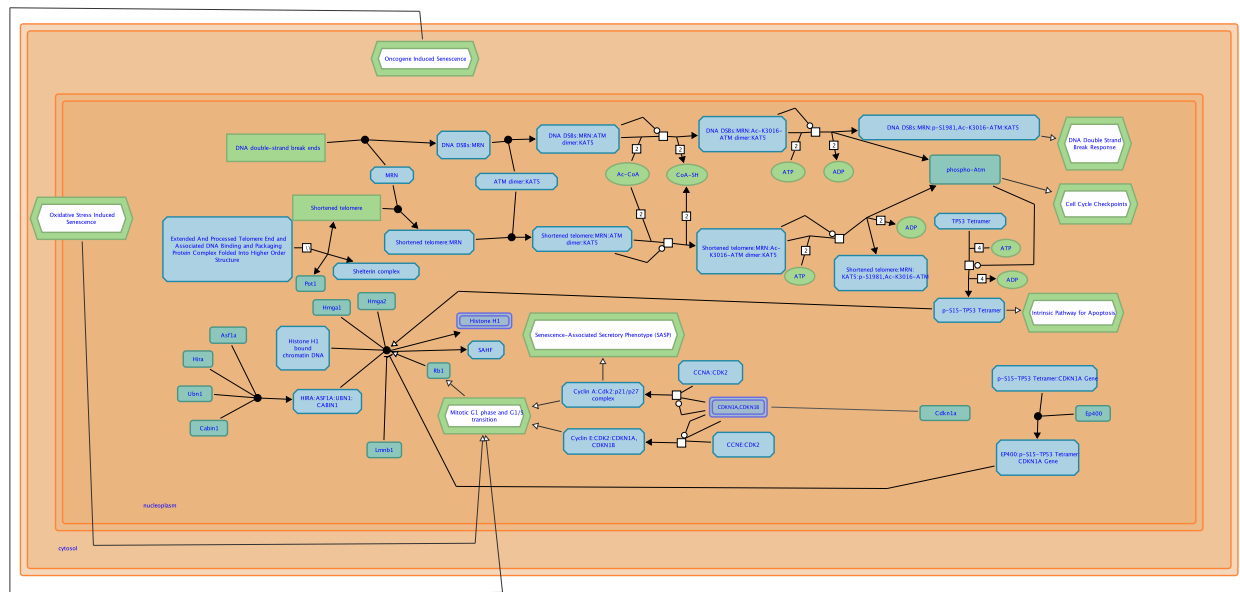


DNA Damage/Telomere Stress Induced Senescence



European Bioinformatics Institute, New York University Langone Medical Center, Ontario Institute for Cancer Research, Oregon Health and Science University.

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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.

The development of Reactome is supported by grants from the US National Institutes of Health (P41 HG003751), University of Toronto (CFREF Medicine by Design), European Union (EU STRP, EMI-CD), and the European Molecular Biology Laboratory (EBI Industry program).

Literature references

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- Fabregat, A., Jupe, S., Matthews, L., Sidiropoulos, K., Gillespie, M., Garapati, P. et al. (2018). The Reactome Pathway Knowledgebase. *Nucleic Acids Res*, 46, D649-D655. [↗](#)
- Fabregat, A., Korninger, F., Viteri, G., Sidiropoulos, K., Marin-Garcia, P., Ping, P. et al. (2018). Reactome graph database: Efficient access to complex pathway data. *PLoS computational biology*, 14, e1005968. [↗](#)

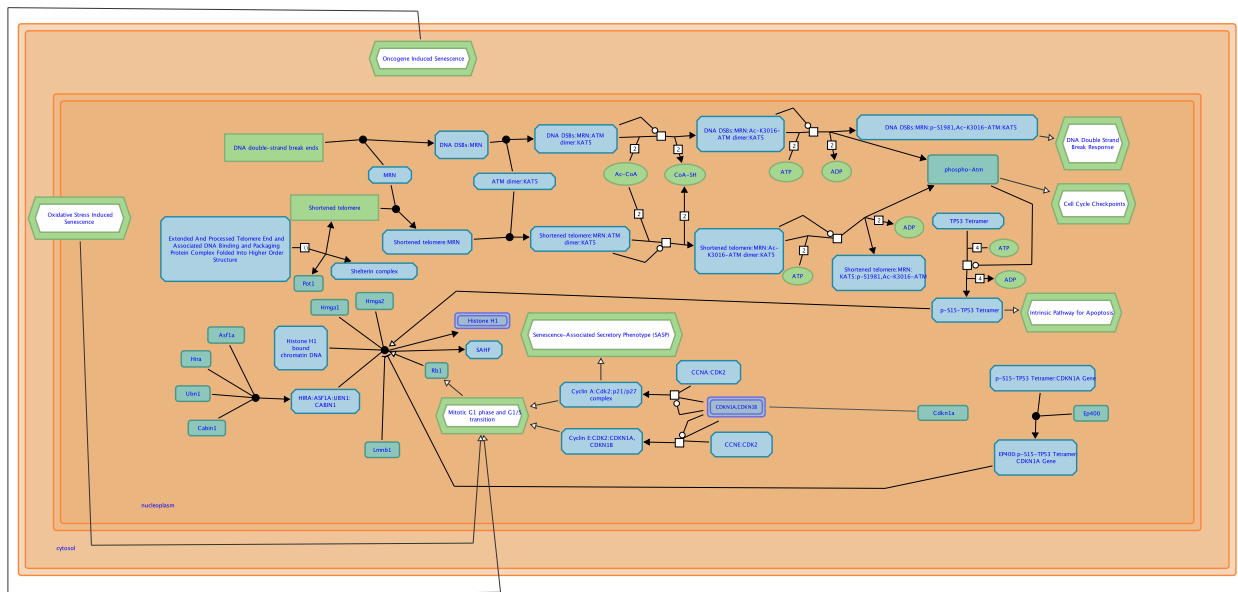
Reactome database release: 77

This document contains 2 pathways and 13 reactions ([see Table of Contents](#))

DNA Damage/Telomere Stress Induced Senescence ↗

Stable identifier: R-RNO-2559586

Inferred from: DNA Damage/Telomere Stress Induced Senescence (Homo sapiens)



reactome

This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Telomere shortening during replicative exhaustion ↗

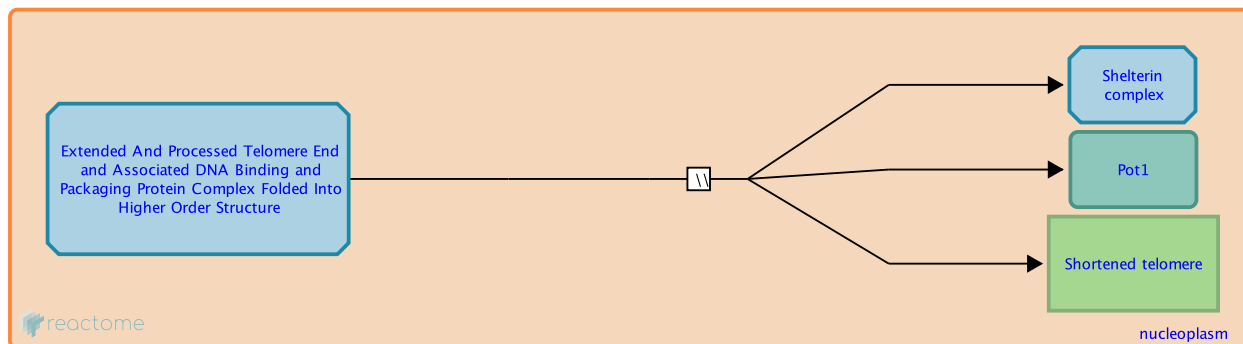
Location: [DNA Damage/Telomere Stress Induced Senescence](#)

Stable identifier: R-RNO-3785711

Type: omitted

Compartments: nucleoplasm

Inferred from: [Telomere shortening during replicative exhaustion \(Homo sapiens\)](#)



This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Followed by: [MRN complex binds shortened telomeres](#)

MRN complex binds DNA double strand breaks ↗

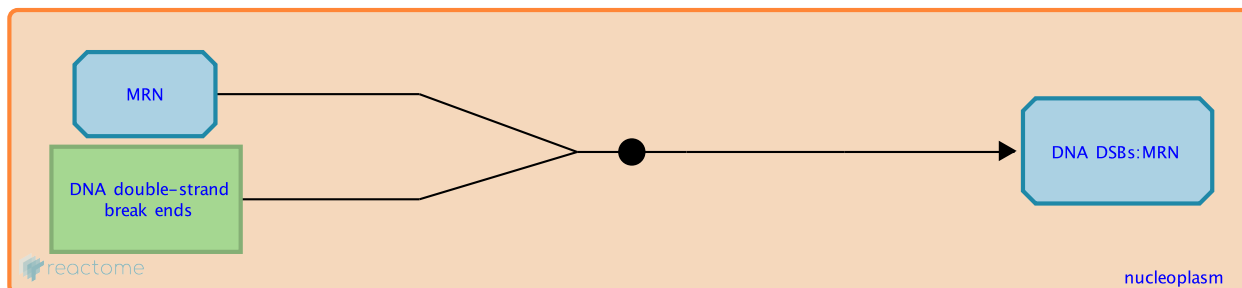
Location: [DNA Damage/Telomere Stress Induced Senescence](#)

Stable identifier: R-RNO-3785768

Type: binding

Compartments: nucleoplasm

Inferred from: [MRN complex binds DNA double strand breaks \(Homo sapiens\)](#)



This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Followed by: [MRN complex bound to DNA ends recruits ATM](#)

MRN complex binds shortened telomeres ↗

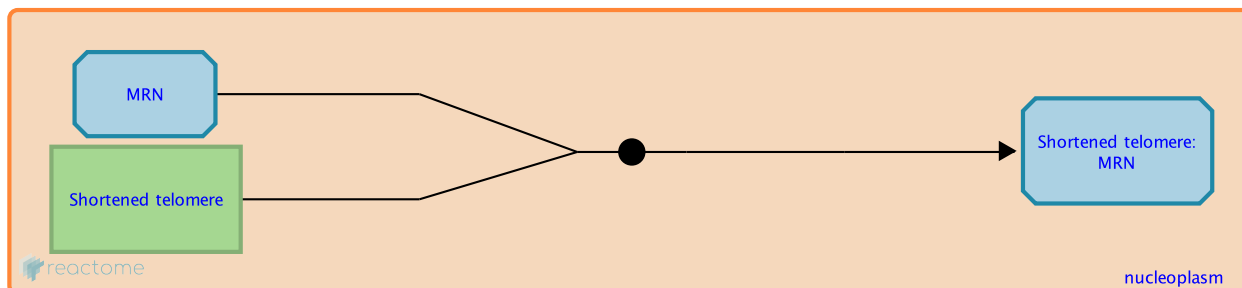
Location: [DNA Damage/Telomere Stress Induced Senescence](#)

Stable identifier: R-RNO-5682020

Type: binding

Compartments: nucleoplasm

Inferred from: [MRN complex binds shortened telomeres \(Homo sapiens\)](#)



This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Preceded by: [Telomere shortening during replicative exhaustion](#)

Followed by: [MRN complex bound to shortened telomeres recruits ATM](#)

MRN complex bound to DNA ends recruits ATM ↗

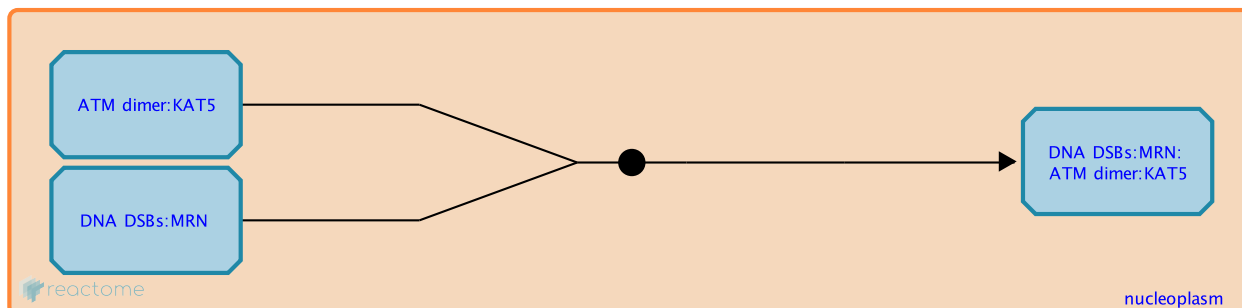
Location: [DNA Damage/Telomere Stress Induced Senescence](#)

Stable identifier: R-RNO-5693612

Type: binding

Compartments: nucleoplasm

Inferred from: [MRN complex bound to DNA ends recruits ATM \(Homo sapiens\)](#)



This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Preceded by: [MRN complex binds DNA double strand breaks](#)

Followed by: [KAT5 acetylates ATM at DNA DSBs](#)

KAT5 acetylates ATM at DNA DSBs ↗

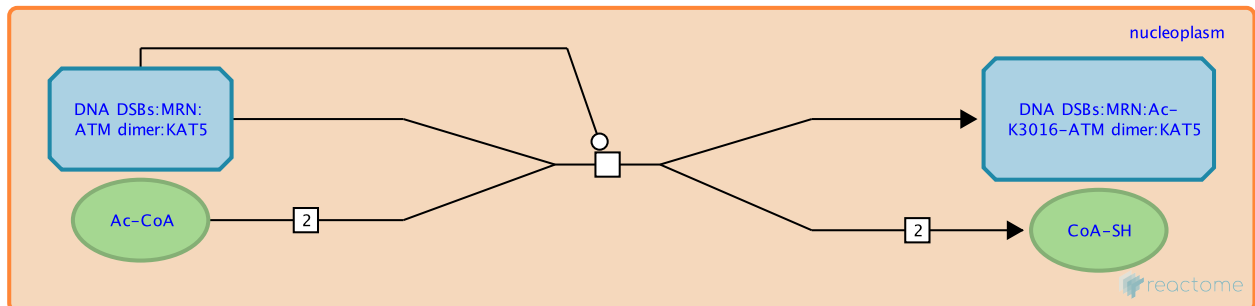
Location: [DNA Damage/Telomere Stress Induced Senescence](#)

Stable identifier: R-RNO-5682044

Type: transition

Compartments: nucleoplasm

Inferred from: [KAT5 acetylates ATM at DNA DSBs \(Homo sapiens\)](#)



This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Preceded by: [MRN complex bound to DNA ends recruits ATM](#)

Followed by: [MRN activates ATM](#)

MRN activates ATM ↗

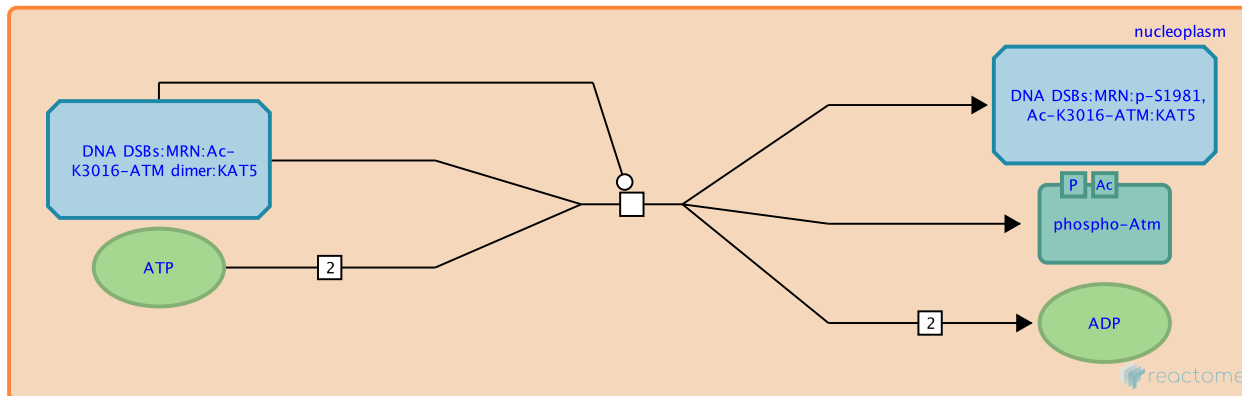
Location: DNA Damage/Telomere Stress Induced Senescence

Stable identifier: R-RNO-5693540

Type: transition

Compartments: nucleoplasm

Inferred from: MRN activates ATM (Homo sapiens)



This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Preceded by: KAT5 acetylates ATM at DNA DSBs

Followed by: ATM phosphorylates TP53 at S15

MRN complex bound to shortened telomeres recruits ATM ↗

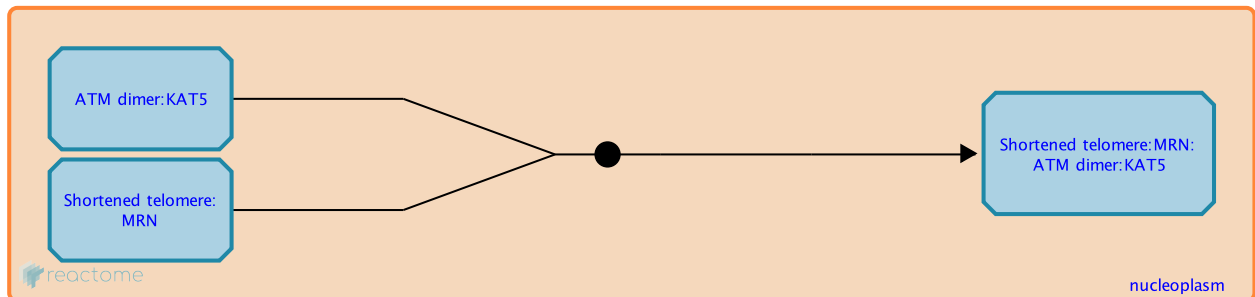
Location: [DNA Damage/Telomere Stress Induced Senescence](#)

Stable identifier: R-RNO-5682018

Type: binding

Compartments: nucleoplasm

Inferred from: [MRN complex bound to shortened telomeres recruits ATM \(Homo sapiens\)](#)



This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Preceded by: [MRN complex binds shortened telomeres](#)

Followed by: [KAT5 acetylates ATM at shortened telomeres](#)

KAT5 acetylates ATM at shortened telomeres ↗

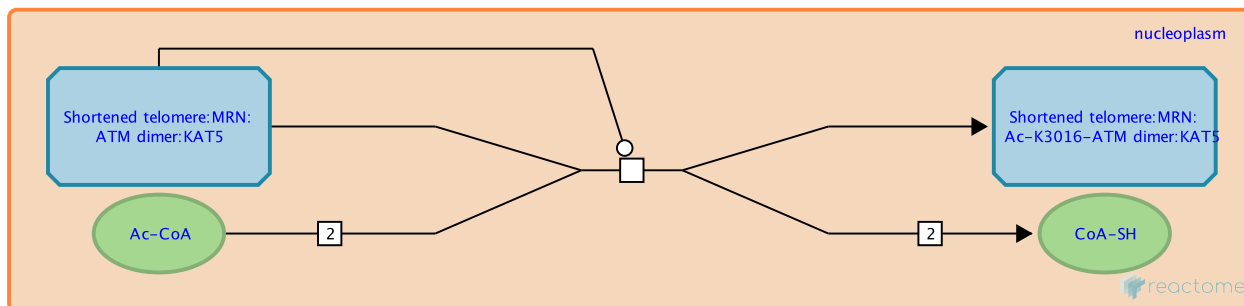
Location: DNA Damage/Telomere Stress Induced Senescence

Stable identifier: R-RNO-6792712

Type: transition

Compartments: nucleoplasm

Inferred from: KAT5 acetylates ATM at shortened telomeres (Homo sapiens)



This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Preceded by: MRN complex bound to shortened telomeres recruits ATM

Followed by: MRN bound to shortened telomeres activates ATM

MRN bound to shortened telomeres activates ATM ↗

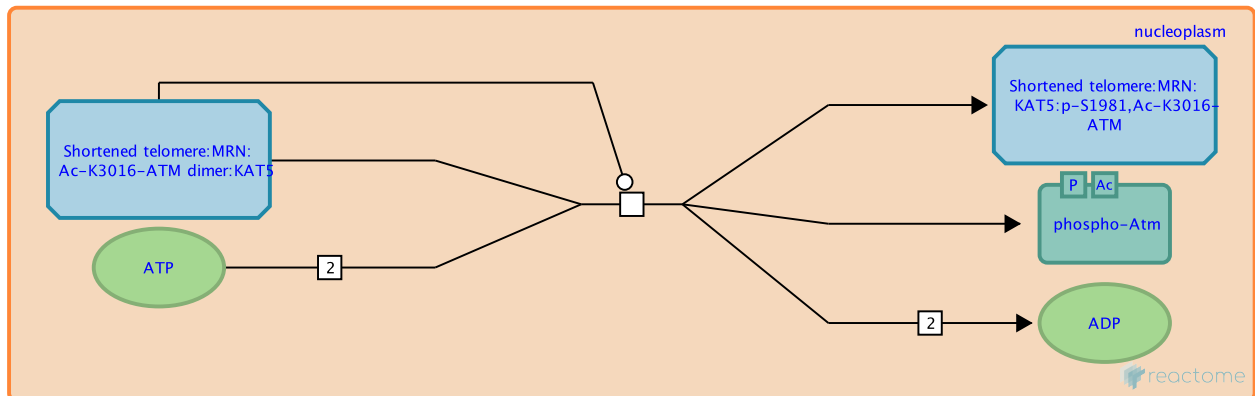
Location: DNA Damage/Telomere Stress Induced Senescence

Stable identifier: R-RNO-5682026

Type: transition

Compartments: nucleoplasm

Inferred from: MRN bound to shortened telomeres activates ATM (Homo sapiens)



This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Preceded by: KAT5 acetylates ATM at shortened telomeres

Followed by: ATM phosphorylates TP53 at S15

ATM phosphorylates TP53 at S15 ↗

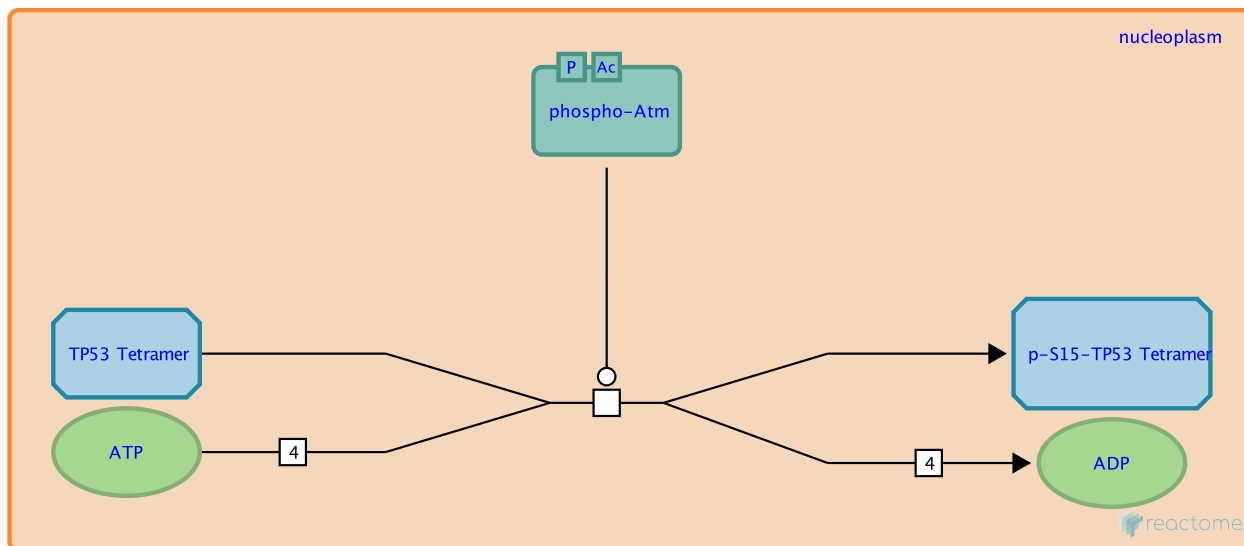
Location: DNA Damage/Telomere Stress Induced Senescence

Stable identifier: R-RNO-5693609

Type: transition

Compartments: nucleoplasm

Inferred from: ATM phosphorylates TP53 at S15 (Homo sapiens)



This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Preceded by: MRN activates ATM, MRN bound to shortened telomeres activates ATM

EP400 binds CDKN1A promoter ↗

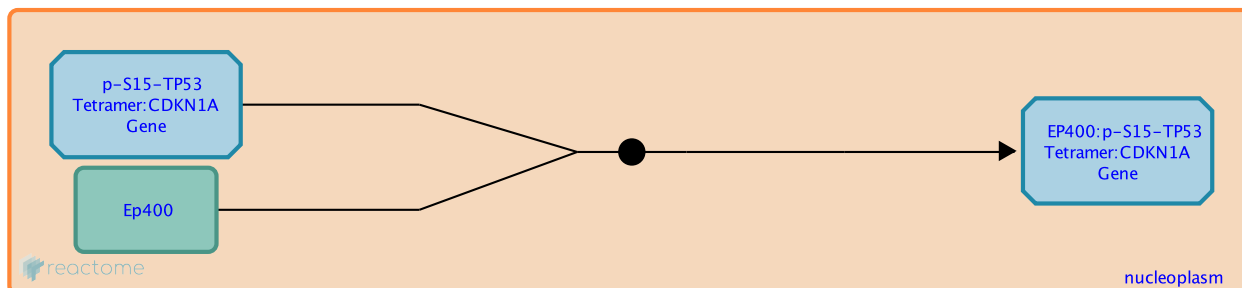
Location: DNA Damage/Telomere Stress Induced Senescence

Stable identifier: R-RNO-4647593

Type: binding

Compartments: nucleoplasm

Inferred from: EP400 binds CDKN1A promoter (Homo sapiens)



This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Inactivation of Cyclin A:Cdk2 complexes by p27/p21 ↗

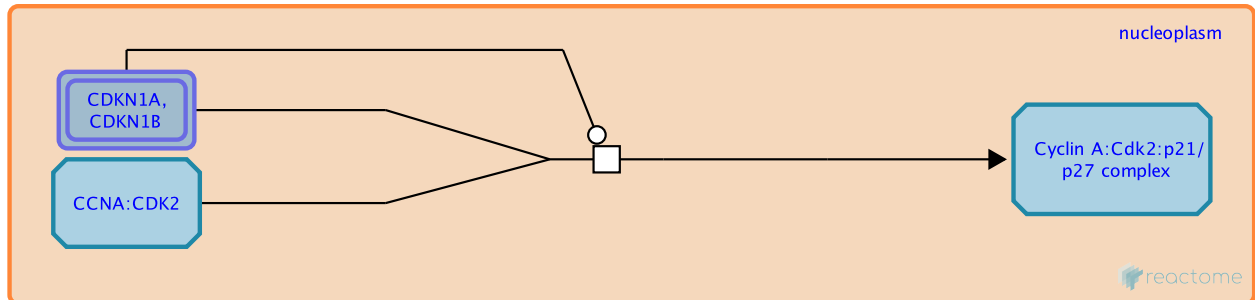
Location: DNA Damage/Telomere Stress Induced Senescence

Stable identifier: R-RNO-187934

Type: transition

Compartments: nucleoplasm

Inferred from: Inactivation of Cyclin A:Cdk2 complexes by p27/p21 (Homo sapiens)



This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Inactivation of Cyclin E:Cdk2 complexes by p27/p21 ↗

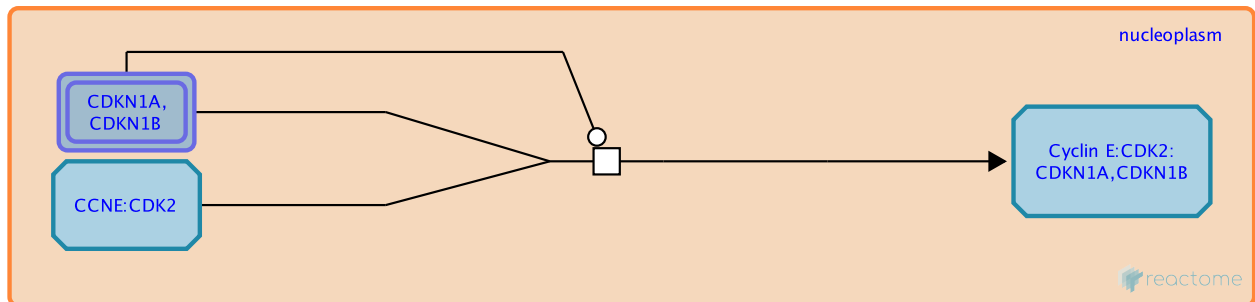
Location: DNA Damage/Telomere Stress Induced Senescence

Stable identifier: R-RNO-69562

Type: transition

Compartments: nucleoplasm

Inferred from: Inactivation of Cyclin E:Cdk2 complexes by p27/p21 (Homo sapiens)



This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

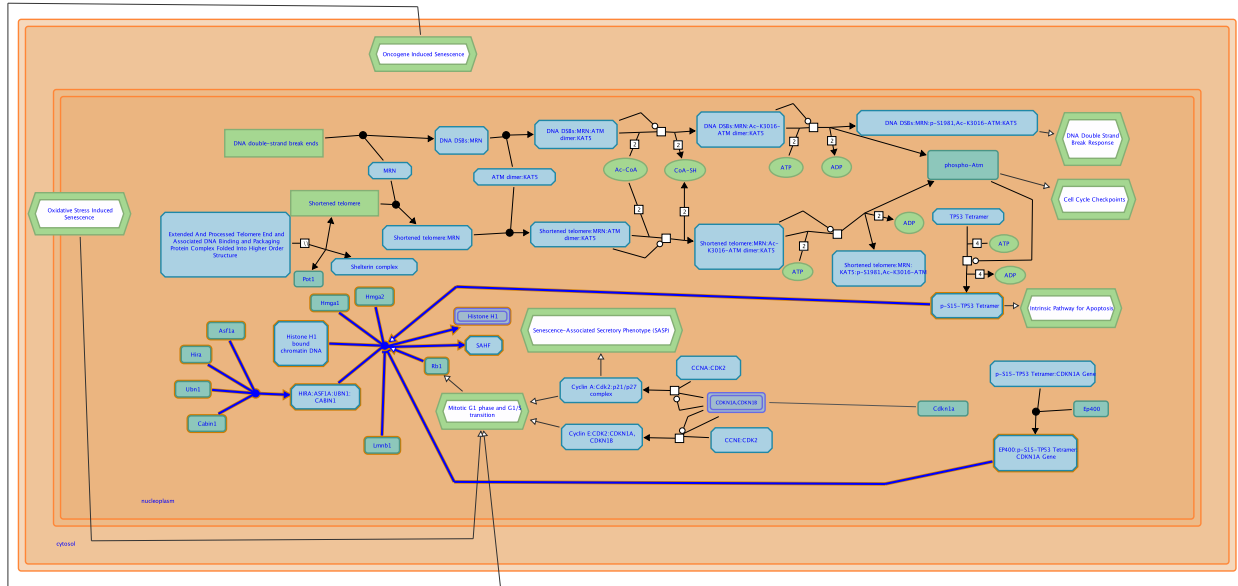
[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Formation of Senescence-Associated Heterochromatin Foci (SAHF) ↗

Location: DNA Damage/Telomere Stress Induced Senescence

Stable identifier: R-RNO-2559584

Inferred from: Formation of Senescence-Associated Heterochromatin Foci (SAHF) (Homo sapiens)



reactome

This event has been computationally inferred from an event that has been demonstrated in another species.

The inference is based on the homology mapping from PANTHER. Briefly, reactions for which all involved PhysicalEntities (in input, output and catalyst) have a mapped orthologue/paralogue (for complexes at least 75% of components must have a mapping) are inferred to the other species. High level events are also inferred for these events to allow for easier navigation.

[More details and caveats of the event inference in Reactome.](/electronic_inference_compara.html) For details on PANTHER see also: <http://www.pantherdb.org/about.jsp>

Table of Contents

Introduction	1
☒ DNA Damage/Telomere Stress Induced Senescence	2
☒ Telomere shortening during replicative exhaustion	3
☒ MRN complex binds DNA double strand breaks	4
☒ MRN complex binds shortened telomeres	5
☒ MRN complex bound to DNA ends recruits ATM	6
☒ KAT5 acetylates ATM at DNA DSBs	7
☒ MRN activates ATM	8
☒ MRN complex bound to shortened telomeres recruits ATM	9
☒ KAT5 acetylates ATM at shortened telomeres	10
☒ MRN bound to shortened telomeres activates ATM	11
☒ ATM phosphorylates TP53 at S15	12
☒ EP400 binds CDKN1A promoter	13
☒ Inactivation of Cyclin A:Cdk2 complexes by p27/p21	14
☒ Inactivation of Cyclin E:Cdk2 complexes by p27/p21	15
☒ Formation of Senescence-Associated Heterochromatin Foci (SAHF)	16
Table of Contents	17