



RARA gene

retinoic acid receptor alpha

Normal Function

The *RARA* gene provides instructions for making a transcription factor called the retinoic acid receptor, alpha ($RAR\alpha$). A transcription factor is a protein that attaches (binds) to specific regions of DNA and helps control the activity of particular genes. The $RAR\alpha$ protein controls the activity (transcription) of genes that are important for the maturation (differentiation) of immature white blood cells beyond a particular stage called the promyelocyte.

The $RAR\alpha$ protein binds to specific regions of DNA and attracts other proteins that help block (repress) gene transcription, the first step in protein production. In response to a specific signal, the repressive proteins are removed and other proteins that induce gene transcription bind to the $RAR\alpha$ protein, allowing gene transcription and cell differentiation.

Health Conditions Related to Genetic Changes

Acute promyelocytic leukemia

Gene mutations can be acquired during a person's lifetime and are present only in certain cells. These mutations are called somatic mutations, and they are not inherited. A somatic mutation involving the *RARA* gene causes acute promyelocytic leukemia, a cancer of the blood forming tissue (bone marrow). Acute promyelocytic leukemia is characterized by an accumulation of promyelocytes in the bone marrow. A rearrangement (translocation) of genetic material between chromosomes 15 and 17, written as t(15;17), fuses part of the *RARA* gene on chromosome 17 with part of another gene on chromosome 15 called *PML*. The protein produced from this fused gene, the PML- $RAR\alpha$ protein, functions differently than the protein products of the normal *PML* and *RARA* genes.

The PML- $RAR\alpha$ protein binds to DNA and represses gene transcription, like the normal $RAR\alpha$ protein. However, the PML- $RAR\alpha$ protein does not respond to the signal to induce transcription of genes, so the genes remain repressed.

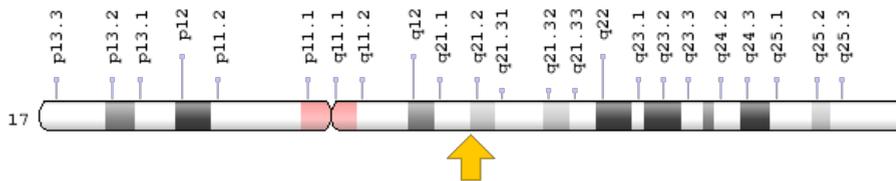
Additionally, the function of the PML protein, the product of the *PML* gene, is disrupted. The PML protein blocks cell growth and division (proliferation) and induces self-destruction (apoptosis) in combination with other proteins. However, the PML- $RAR\alpha$ protein does not block proliferation or induce apoptosis.

The PML-RAR α protein blocks the differentiation of blood cells at the promyelocyte stage and allows abnormal cell proliferation. As a result, excess promyelocytes accumulate in the bone marrow and normal white blood cells cannot form, leading to acute promyelocytic leukemia.

Chromosomal Location

Cytogenetic Location: 17q21.2, which is the long (q) arm of chromosome 17 at position 21.2

Molecular Location: base pairs 40,309,180 to 40,357,643 on chromosome 17 (Homo sapiens Updated Annotation Release 109.20190607, GRCh38.p13) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- NR1B1
- nuclear receptor subfamily 1 group B member 1
- RAR
- RAR-alpha
- retinoic acid receptor, alpha

Additional Information & Resources

Educational Resources

- Holland-Frei Cancer Medicine (6th Edition, 2003): Translocations Involving RAR α . <https://www.ncbi.nlm.nih.gov/books/NBK12465/#A44441>

Scientific Articles on PubMed

- PubMed <https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28RARA%5BTIAB%5D%29+OR+%28retinoic+acid+receptor+alpha%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5BIa%5D+AND+human%5Bmh%5D+AND+%22last+720+days%22%5Bdp%5D>

Catalog of Genes and Diseases from OMIM

- RETINOIC ACID RECEPTOR, ALPHA
<http://omim.org/entry/180240>

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
<http://atlasgeneticsoncology.org/Genes/RARAID46.html>
- ClinVar
<https://www.ncbi.nlm.nih.gov/clinvar?term=RARA%5Bgene%5D>
- HGNC Gene Symbol Report
https://www.genenames.org/data/gene-symbol-report/#!/hgnc_id/HGNC:9864
- Monarch Initiative
<https://monarchinitiative.org/gene/NCBIGene:5914>
- NCBI Gene
<https://www.ncbi.nlm.nih.gov/gene/5914>
- UniProt
<https://www.uniprot.org/uniprot/P10276>

Sources for This Summary

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