



AIRE gene

autoimmune regulator

Normal Function

The *AIRE* gene provides instructions for making a protein called the autoimmune regulator. This protein is active primarily in the thymus, which is an organ located behind the breastbone that plays an important role in immune system function. The thymus prepares immune cells called T cells for their role in fighting infection; this process is called thymic education.

For a person to remain healthy, immune system cells such as T cells must be able to identify and destroy potentially harmful invaders (such as bacteria, fungi, and viruses) while sparing the body's normal tissues. The autoimmune regulator protein plays an important role in this process by helping T cells distinguish the body's own proteins from those of foreign invaders. When this system malfunctions, the immune system's ability to distinguish between the body's proteins and foreign invaders is impaired, and it may attack the body's own tissues and organs. This abnormal reaction is called autoimmunity. In the thymus, the autoimmune regulator protein destroys T cells that otherwise would cause autoimmune damage.

Health Conditions Related to Genetic Changes

Autoimmune polyendocrinopathy-candidiasis-ectodermal dystrophy

More than 90 mutations in the *AIRE* gene have been identified in people with autoimmune polyendocrinopathy-candidiasis-ectodermal dystrophy (APECED). APECED is an inherited condition that affects many of the body's organs. A major feature of this disorder is chronic mucocutaneous candidiasis (CMC), which is a tendency to develop infections of the skin, the nails, and the moist lining of body cavities (mucous membranes) caused by a type of fungus called *Candida*. Other common signs and symptoms of APECED involve dysfunction of the body's network of hormone-producing glands (the endocrine system), as well as other organs and tissues.

The *AIRE* gene mutations that cause APECED lead to the production of an abnormally short, nonfunctional version of the autoimmune regulator protein or change single protein building blocks (amino acids) in critical regions of the protein. These mutations reduce or eliminate the function of the autoimmune regulator protein. Without enough of this protein function, the immune system's ability to distinguish between the body's proteins and foreign invaders is impaired, and immune cells may attack the body's own organs, resulting in autoimmunity. This abnormal reaction leads to inflammation and can damage otherwise healthy cells and

tissues. Autoimmune damage to the adrenal glands, parathyroid glands, and other organs underlies many of the major features of APECED.

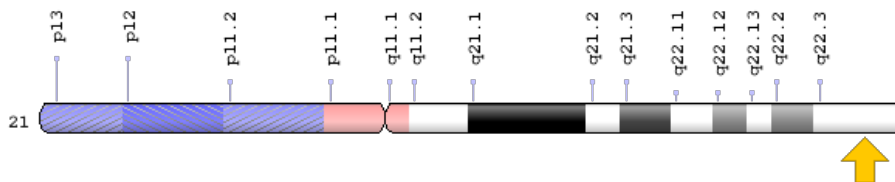
Studies suggest that *AIRE* gene mutations also result in immune substances (antibodies) mistakenly attacking proteins involved in an immune process called the IL-17 pathway, which is important in the body's defense against *Candida*. This pathway, which depends on specialized proteins called IL-17 cytokines for signaling, creates inflammation, sending additional cytokines and white blood cells to fight foreign invaders and promote tissue repair. In addition, the IL-17 pathway promotes the production of certain antimicrobial protein segments (peptides) that control growth of *Candida* on the surface of mucous membranes. By damaging IL-17 cytokines, *AIRE* gene mutations are thought to impair the IL-17 pathway's function, resulting in CMC in people with APECED.

Alopecia areata

Chromosomal Location

Cytogenetic Location: 21q22.3, which is the long (q) arm of chromosome 21 at position 22.3

Molecular Location: base pairs 44,285,838 to 44,298,219 on chromosome 21 (Homo sapiens Annotation Release 109, GRCh38.p12) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- AIRE1
- AIRE_HUMAN
- APECED
- APS1
- APSI
- Autoimmune polyendocrinopathy candidiasis ectodermal dystrophy protein
- PGA1

Additional Information & Resources

Educational Resources

- Immunobiology (fifth edition, 2001): Autoimmune responses are directed against self antigens
<https://www.ncbi.nlm.nih.gov/books/NBK27155/>

Scientific Articles on PubMed

- PubMed
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28AIRE%5BTIAB%5D%29+OR+%28autoimmune+regulator%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+720+days%22%5Bdp%5D>

Catalog of Genes and Diseases from OMIM

- AUTOIMMUNE REGULATOR
<http://omim.org/entry/607358>

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
http://atlasgeneticsoncology.org/Genes/GC_AIRE.html
- ClinVar
<https://www.ncbi.nlm.nih.gov/clinvar?term=AIRE%5Bgene%5D>
- HGNC Gene Symbol Report
https://www.genenames.org/data/gene-symbol-report#!/hgnc_id/HGNC:360
- Monarch Initiative
<https://monarchinitiative.org/gene/NCBIGene:326>
- NCBI Gene
<https://www.ncbi.nlm.nih.gov/gene/326>
- UniProt
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